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Analysis of a Land Disposal Damage Incident Involving Hazardous Waste Materials. Dover Township, New Jersey

TRW Systems Group, Redondo Beach, Calif

Prepared for

Environmental Protection Agency, Washington, D C Hazardous Waste Management Div

May 76

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FINAL REPORT

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MAY, 1976

By:
M. Ghassemi

CONTRACT NO. 68-01-2956
TASK ORDER 68-01-3187

PROJECT OFFICER: EMERY C. LAZAR

HAZARDOUS WASTE MANAGEMENT DIVISION
OFFICE OF SOLID WASTE MANAGEMENT PROGRAMS - EPA
WASHINGTON, D. C. 20460

Prepared for
U. S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF SOLID WASTE MANAGEMENT PROGRAMS
WASHINGTON, D. C.

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NOTICE

In view of the nature of the work under Contract No. BOA 68-01-2956, Task Order 68-01-3187, Contractor's responsibility has been limited to applying its best efforts in the performance of such work by competent staff within the limits of time and funds provided. TRW does not assume responsibility for the consequences of any use or inability to use any information in this report.

PREFACE AND ACKNOWLEDGEMENTS

This report presents the results of fact-gathering investigation of an incident of groundwater contamination in Dover Township, New Jersey, allegedly resulting from improper storage/disposal of hazardous wastes. The study was conducted by TRW Systems under Contract BOA 68-01-2956, Task Order 68-01-3187, for the EPA Office of Solid Waste Management Programs, Hazardous Waste Management Division. The project is deeply indebted to the EPA Project Officer, Mr. Emery C. Lazar, for his continuing advice and guidance during the course of the study. Thanks are also due to Mr. Robert Testani and other staff members of the Office of Solid Waste Management Programs, for their critical review of the draft final report.

TRW wishes to express its sincere gratitude to the individuals listed in Table A-1 in the Appendix who granted interviews and provided information for use in this report.

Special thanks are due to Dr. Jack Blumenthal, Dr. Robert S. Ottinger, Mr. Bernie Dubrow and Mr. William Leach of TRW for their critical review of the draft final report. The author wishes to express his sincere gratitude to Ms. Irene Lamar and Ms. Marilyn Jennings for editorial review of the report and to Ms. Sharon Cavin and Ms. Linda Broberg for their stenographic services.

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1.0 SUMMARY

Under contract to the U.S. Environmental Protection Agency, Office of Solid Waste Management Programs, Hazardous Waste Management Division, TRW undertook a fact-gathering investigation to explore and document the technical, environmental, economic, social and political aspects of a damage incident in the Pleasant Plains section of Dover Township, near Toms River, New Jersey, resulting from improper storage/land disposal of hazardous industrial wastes. This report, which is herein submitted in connection with the investigation, contains a brief overview of the events related to the incident, technical evaluation and analysis of the collected data and discussion of the economic damage and the environmental, social, political and regulatory aspects of the incident. The findings are integrated into a set of specific conclusions which are valuable from the standpoint of avoiding incidents of a similar nature in the future.

The data and documents used in the preparation of this report were obtained through field interviews and telephone inquiries. The individuals interviewed had been intimately involved with the incident and included officials in local, State and Federal agencies, area residents, lawyers, physicians, businessmen, and newspaper reporters. Many documents were collected as a result of the field interviews, including court records, newspaper stories, photographs, and technical reports, memoranda, and correspondence from State, County and Township files.

In March 1971 Union Carbide Corporation (UCC) contracted with Nicholas Fernicola, an independent waste hauler, to remove drums containing chemical wastes from its manufacturing facility in Bound Brook, New Jersey, and to transport them to the Dover Township Municipal Landfill in Dover Township, New Jersey, for ultimate disposal. The wastes consisted of organic wash solvents and still bottoms and residues from the manufacturing of organic chemicals, plastics and resins. The initial deposition of the waste drums in the Dover Township Municipal Landfill was verified by a UCC representative. In December 1971, UCC was notified by Mr. and Mrs. Samuel Reich, residents in the Pleasant Plains section of Dover Township, that thousands of waste drums with UCC labels had been discovered on a section of their farm which was rented to Mr. Nicholas Fernicola.

According to Mr. and Mrs. Reich, Mr. Fernicola had leased the property (for $40 per month) under the pretense that he was in the business of buying and selling used (empty) drums and that he needed a temporary storage place so that he could accumulate a sufficient number of drums to constitute a full load for delivery to ultimate purchasers. When discovered, there were about 4,500 drums on the premises. Most of the drums were full and carried labels as to their flammable, explosive and/or oxidizing nature. There were a number of trenches dug on the property into which the contents of some of the drums had been emptied.

The Reichs requested UCC and Fernicola to remove the drums from their property and to clean up the premises. The incident was also reported to appropriate local and State agencies. Since affirmative action did not appear to be forthcoming, the Reichs initiated a court action against UCC and Fernicola. On the grounds that the storage of the chemicals on the Reichs' property constituted a public nuisance and endangered the lives and property of Dover Township residents, the Township of Dover and the Board of Health of the Township of Dover initiated a similar court action. On January 31, 1972 the court ordered UCC to remove the drums from the premises. By March 30, 1972 the drums were removed from the site by UCC. Responding to a "tip" that additional drums may have been buried at the site, an excavation at the site by the Township of Dover in June 1974 uncovered 51 drums and significant quantities of chemical wastes. Thirty-seven additional drums were also discovered stored in two trucks parked about 4 miles from the Reich farm.

Some of the drums removed from the Reich farm by UCC were returned to the Bound Brook facility. These drums generally contained heavy still bottoms and tarry organic matter. The remainder of the drums were disposed of by deposition in the Kin-Buc landfill in New Jersey, and by incineration at the UCC plant in Ohio and at the Rollins-Purle facility in Logan Township, New Jersey.

Early in 1974, about 2 years after the discovery of chemical waste storage/disposal at the Reich farm, some of the residents in the area discovered an unusual taste and odor in their well water. Subsequent chemical analyses of water samples from these and other wells in the area indicated the presence of petrochemical contaminants. On the basis of these analytical results, the very strong and persistent taste and odor problem associated with the water from some of the wells, and the documented case of waste chemical storage and burial on the nearby Reich farm, the New Jersey State Department of Environmental Protection concluded that the groundwater in the Cohansey aquifer in at least the immediate vicinity of the disposal site was contaminated with hazardous organic chemicals. To protect the health of the area residents, the local Board of Health passed an ordinance forbidding the use of well water for any purpose. Overall, a total of 148 private wells were condemned and ordered to be permanently capped. For a period of about 6 months, while steps were being taken to extend services of Toms River Water Company to the area on a permanent basis, an emergency water supply was provided to the residents by using water tankers stationed at strategic locations in the area. Some residents and public facilities used bottled water for drinking and cooking purposes. In some sections of the area, where construction of new wells was still allowed, the wells had to be constructed to a greater depth to obtain uncontaminated water from the Kirkwood aquifer.

In the initial analyses of water samples, an extraction/gravimetric procedure was used for the determination of extractable organics ("oil and grease"). Values for well water samples from Pleasant Plains were generally in the 0 to 10 ppm range with a few samples having values in the 10 to 20 ppm range. Later when the water sampling and analyses were expanded to include additional wells, gas chromatography (GC), solvent extraction/infrared (IR) spectrophotometry and carbon-chloroform extraction (CCE) techniques were used for the determination of organics. Four water samples were also tested by the gas chromatography/mass spectroscopy (GS/MS) technique.

GC analysis generally failed to identify individual chemical components in the water samples. The solvent extraction/IR method indicated extractable organic contents mostly in the 0 to 1 ppm range. With the exception of one sample having a CCE value of 1.2 ppm, all CCE values were less than 0.7 ppm, which is the maximum allowable level under U.S. Public Health Service Drinking Water Standards. Of the four samples tested by the GC/MS method, one sample showed the presence of toluene and styrene at concentrations of 12 ppb and 30 ppb, respectively. At a detection limit of 0.1 ppb, these chemicals could not be detected in the other three samples.

Based on the information supplied by UCC on the general chemical makeup of the wastes, some of the waste drums contained toxic and flammable material, thereby requiring caution in handling, transportation, storage and disposal. Although some of the specific chemicals contained in the wastes are toxic and could have posed a serious health hazard if taken internally via consumption of contaminated groundwater, fortunately there were no substantiated and medically documented cases of illness in humans and animals in the area.

In addition to the Reich farm, there are several other possible sources which may have contributed to groundwater contamination in that area of Ocean County. These include Dover Township Municipal Landfill into which chemical wastes have been discharged, the Toms River Chemical Corporation (TRC) plant in Dover Township, and various locations at which unauthorized waste disposal has allegedly occurred. The TRC plant produces synthetic dyes and utilizes sedimentation and biological ponds for the treatment of its liquid wastes. These treatment units are not lined and wastewater can conceivably percolate into the groundwater.

For discussion purposes, the economic aspects of the incident in Dover Township have been considered in terms of direct damage costs, health and safety protection costs, indirect costs and comparative abatement costs. The total for the direct damage costs is estimated at $70,150, with major items consisting of the required capping of wells ($44,400), and costs for drum removal and site cleanup ($25,750). These costs do not include any damage which may surface in the future as a result of a possible spread of contamination. The health and safety protection costs, which represent the actual costs incurred in warding off the adverse impact of the incident, are estimated at a total of $347,200. Major items in this cost category are extension of public water supply to the area and hook-up to the system ($249,100), wells drilled to the Kirkwood aquifer ($46,000), water sampling and analysis ($38,900), and drilling of observation wells ($8,300). Because of the difficulty in calculating indirect costs, no dollar value has been assigned to items in this cost category which include denial to property owners of the privilege to use private wells, public inconvenience, difficulty in adjusting to the "funny" taste of the chlorinated public water supply, law suits, public hearings, administration expenses, real estate devaluation, and adverse impacts on the local economy. Comparative abatement costs, which represent those not incurred but which would have been incurred if the wastes had instead been handled in an environmentally acceptable manner (e.g., by controlled incineration or disposal in a secured chemical landfill), are estimated at $150,000. This estimate of the comparative abatement costs is appreciably less than the actual damage costs incurred.

The Dover Township incident might have been averted had there been effective legislation and regulations concerning the transportation, treatment, and disposal of hazardous wastes. The state regulations in effect at the time of the incident were inadequate, vague, and unenforced. There was no system of accountability to ensure that the waste hauled away by a private contractor would reach its intended destination. Chemical wastes were also allowed to enter sanitary landfills which are not designed to receive hazardous chemicals. New regulations which have been proposed by the State are significantly more specific and stringent and require that landfill disposal facilities accepting chemical wastes install a system for the collection and treatment of the leachates. Furthermore, the waste generators are responsible for assuring that the selected waste hauler is registered with the State and that the shipment is consigned to a solid waste facility registered with and authorized by the State for the disposal of specific types of hazardous waste. Both the waste generators and the registered operators of the solid waste facilities are required to submit to the State annual reports on the quantity and nature of the generated/disposed of hazardous wastes. The new State regulations appear to be steps in the right direction for developing a state-wide enforceable program for the control of hazardous wastes.

2.0 CONCLUSIONS

The contamination of groundwater and the economic damages which resulted from the incident in Dover Township could have been averted had there been effective and enforced legislation and regulations concerning the transportation, treatment, and disposal of hazardous wastes.

In New Jersey, as in many other States, large quantities of industrial hazardous wastes have been and are being disposed of in sanitary landfills. Many of these landfills are not designed to contain/degrade hazardous chemicals and, as a result, the disposal practice constitutes a threat to the safety of the operators of the landfill equipment and can lead to the spread of pollutants and contamination of land, water, and air resources.

Until the specifics of the systems proposed by the State of New Jersey for collection and treatment of leachates at landfills accepting chemical wastes are defined, the adequacy of such systems for the containment of hazardous wastes and prevention of spread of pollutants cannot be assessed.

Given their limited manpower, funds, and jurisdictional responsibilities, the State, Federal, and local agencies were unable to respond promptly and effectively to the emergency condition in Dover Township. There existed a feeling of helplessness among some area residents who did not know whom to turn to for assistance and technical guidance.

Despite its unfortunate nature, the incident in Dover Township has been valuable from the standpoint of providing an example of the damages which can result from mismanagement of hazardous wastes. It is very important that the State of New Jersey continue its effort in developing an effective hazardous waste management program.

3.0 INTRODUCTION AND OBJECTIVE OF THE WORK

The following report describes a fact-gathering investigation to document the technical and economic aspects of an incident of groundwater contamination in the Pleasant Plains section of Dover Township (near Toms River) in New Jersey. The incident resulted from alleged improper storage/ disposal of hazardous chemical wastes by an independent waste hauler. The wastes in questions originated from the Union Carbide Corporation (UCC) plant in Bound Brook, New Jersey.

Because of suits which have been brought against UCC by several property owners in Pleasant Plains, and by the New Jersey State Department of Environmental Protection, it was not the aim of this investigation to identify the party or parties at fault or to tackle legal questions which must be addressed in a court of law. Instead, the overall goal of the program was to provide a common forum for review of the technical aspects of the problem so that similar unfortunate incidents can be avoided in the future (in New Jersey and elsewhere in the country). More specifically, the major objectives of this investigation included the following:

- Identification of the possible source(s) of groundwater contamination.
- Review of the water quality data and evaluation of the nature and extent of contamination.
- Assessment of the economic damage resulting from the incident and socio-economic and political implications of the incident.
- Review of the applicable regulations and enforcement policies pertaining to hazardous waste disposal.
- Integration of the findings into a set of specific conclusions pertaining to the technical aspects of the incident.

The data collected in connection with this case-study were obtained through field interviews and telephone inquiries. During the period May 13 to May 22, 1975, eight working days were spent in New Jersey conducting face-to-face interviews with a total of 32 individuals in Trenton, Toms River, and Bound Brook. Telephone discussions were also held with four individuals who were not available for personal interviews. Table A-1 of Appendix A presents a list of the individuals contacted, dates of the interviews (including telephone inquiries), and the specific topics discussed at each interview. Many documents were collected during the field interviews. These documents and the notes made during the interviews are the basis of this report which represents a summary and an analysis of the findings.

4.0 OVERVIEW AND CHRONOLOGY OF EVENTS RELATED TO THE INCIDENT

4.1 Contract Disposal of UCC Wastes

In March 1971 UCC entered into an agreement with Mr. Nicholas Fernicola, an independent waste hauler, for the removal of 208-liter (55-gallon) drums containing chemical wastes from the UCC plant in Bound Brook, New Jersey. The drums were to be taken to the Dover Township Sanitary Landfill (see vicinity and location maps, Figures 1 and 2), which was understood by UCC to be an "approved" landfill for chemical waste disposal. On March 22, 1971 a "trial run" was allegedly carried out whereby the driver of the haul truck was followed to the disposal site by a representative from UCC. The actual removal of the waste drums was started on March 29, 1971. On April 1, 1971 a representative from UCC actually observed that the drums removed from the Bound Brook Plant were being deposited in the Dover Township Landfill by Ferincola.* In return for his services, Fernicola was paid an average of $3.50 for each drum removed.

On December 15, 1971, UCC was notified by Mr. Samuel Reich of Pleasant Plains that thousands of waste drums with UCC labels were stored on a section of his farm which was rented to Mr. Nicholas Fernicola. According to UCC, when notified of the incident, the company immediately stopped Fernicola from removing any additional drums from the Bound Brook facility.

UCC estimates that between 5,000 and 6,000 waste drums were hauled away from the Bound Brook plant during the period March to December 1971. Since only about 4,500 drums were subsequently located on the Reich property, the remainder of the drums are believed to have been deposited in Dover

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* The above account was conveyed to the writer by Messrs. J. D. Baker and S. J. Fortunato (representing UCC) in an interview in Bound Brook on May 22, 1975. According to Mr. Toscan, assistant to the Public Works Superintendent for Dover Township, the landfill in Dover Township services only the Township of Dover; furthermore, the landfill does not accept chemical wastes and any such disposals must have taken place illegally (e.g., at nights) and were not known to the landfill operators. According to Mr. Charles Kaufman (Ocean County Health Coordinator), the Dover Township Landfill also accepts wastes from waste haulers so there is no way of knowing if all the wastes originate from within the Township.

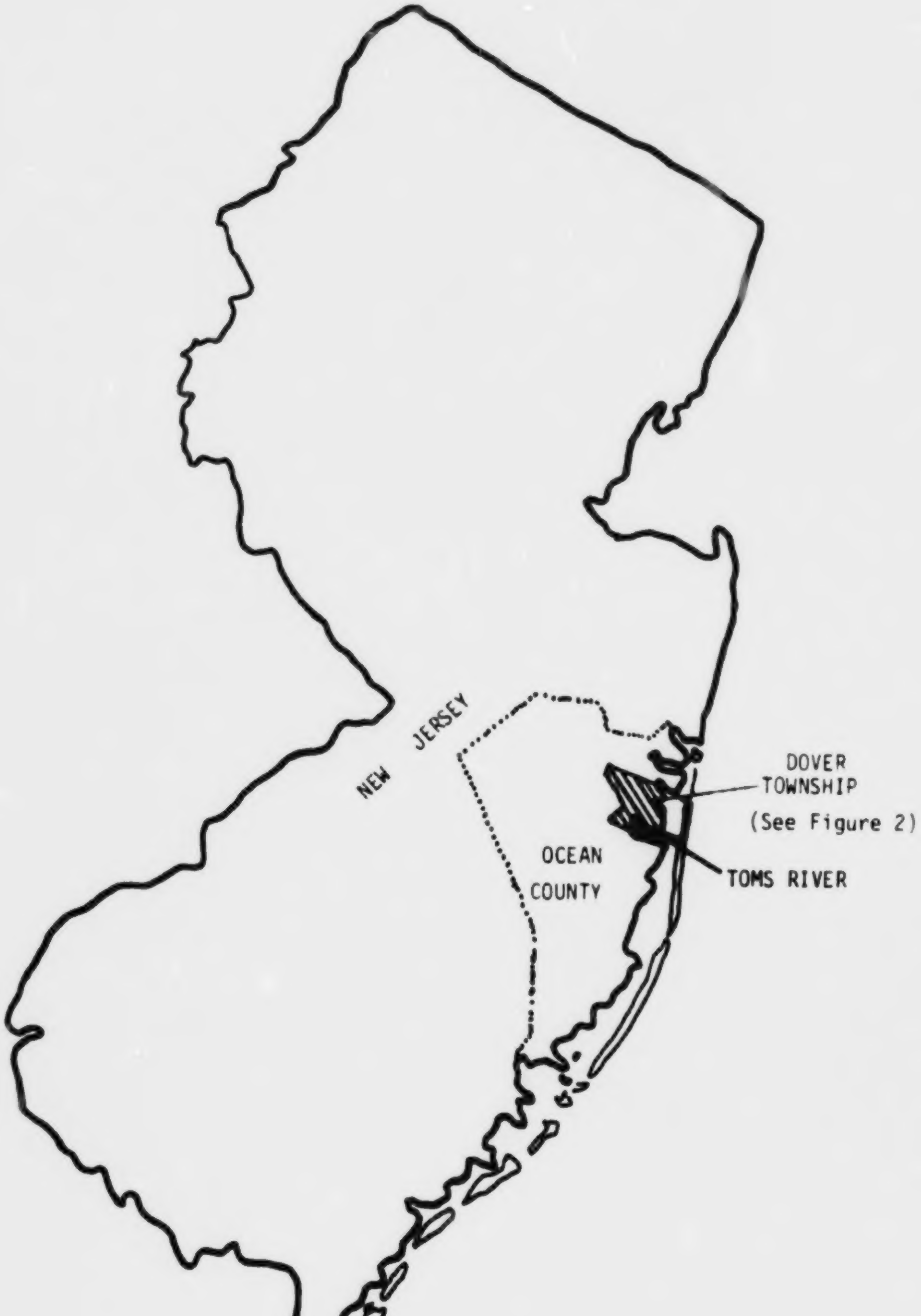
NEW JERSEY
DOVER TOWNSHIP
(See Figure 2)
OCEAN COUNTY
TOMS RIVER

Figure 1. Locations of Ocean County, Dover Township, and Toms River in the State of New Jersey

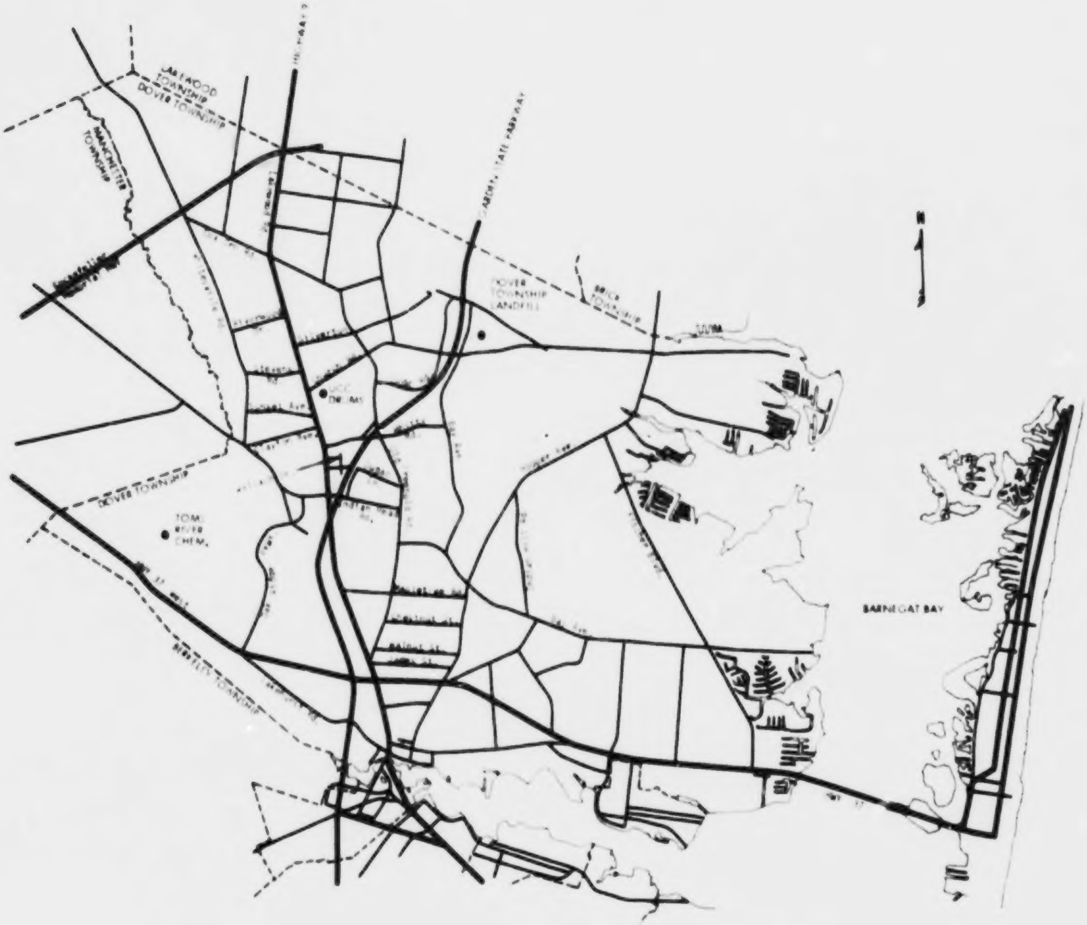
LAKEWOOD TOWNSHIP
DOVER TOWNSHIP
MANCHESTER TOWNSHIP
GARDEN STATE PARKWAY
DOVER TOWNSHIP LANDFILL
BRICK TOWNSHIP
UCC DRUMS
DOVER TOWNSHIP
TOMS RIVER CHEM.
BERKELEY TOWNSHIP
BARNEGAT BAY
N

Figure 2 Map of Dover Township, Showing Locations of the Reich Farm (UCC Drums), Dover Township Landfill, and Toms River Chemical Corporation.

Township Landfill and in landfills in neighboring townships. Some drums were emptied on the Reich property and presumably elsewhere after which the empty drums were salvaged. (Note: Some reports indicate that about 10 percent of the 4,500 drums discovered on the Reich property were partially or completely empty, indicating that the drum contents were also discharged on land or buried at the Reich farm and possibly elsewhere.)

4.2 Storage/Disposal of Waste Drums on the Reich Farm

In August 1971 Mr. and Mrs. Samuel Reich, residing at 1579 Lakewood Road in the Pleasant Plains section of Dover Township, were contacted by Mr. Nicholas Fernicola for possible leasing of a portion of their property (the Reich farm) for temporary storage of empty drums. Mr. Fernicola indicated that he was in the business of buying and selling used barrels and drums and that he needed a temporary storage place so that he could accumulate a sufficient number of drums to constitute a full load for delivery to ultimate purchasers. With this understanding, Mr. and Mrs. Reich leased a portion of their property to Mr. Fernicola for a monthly rental of $40.00 with the lease commencing on August 15, 1971. A few months later, the Reichs noticed that unusual odors often emanated from the back of their property which was leased to Mr. Fernicola. Upon close inspection (in early December 1971) the Reichs discovered that the drums on Mr. Fernicola's section were not few but thousands in number (Figure 3). Also, the containers were not empty; instead, most of the drums were full and contained chemical wastes and carried UCC warning labels as to their flammable, explosive, and/or oxidizing nature (see Figure 4 for typical labels). Furthermore, it was observed that a number of trenches had been dug on the premises into which chemical wastes had been discharged.

Upon discovery of the unauthorized storage of hazardous chemicals on their property, the Reichs requested Mr. Fernicola to remove the waste drums from the premises. However, despite repeated affirmative promises, no visible reduction in the number of stored drums was observed. The Reichs then contacted the New Jersey State Department of Environmental Protection for guidance and assistance. According to Mr. Reich, he was told by the State that storage and disposal or removal of chemical wastes

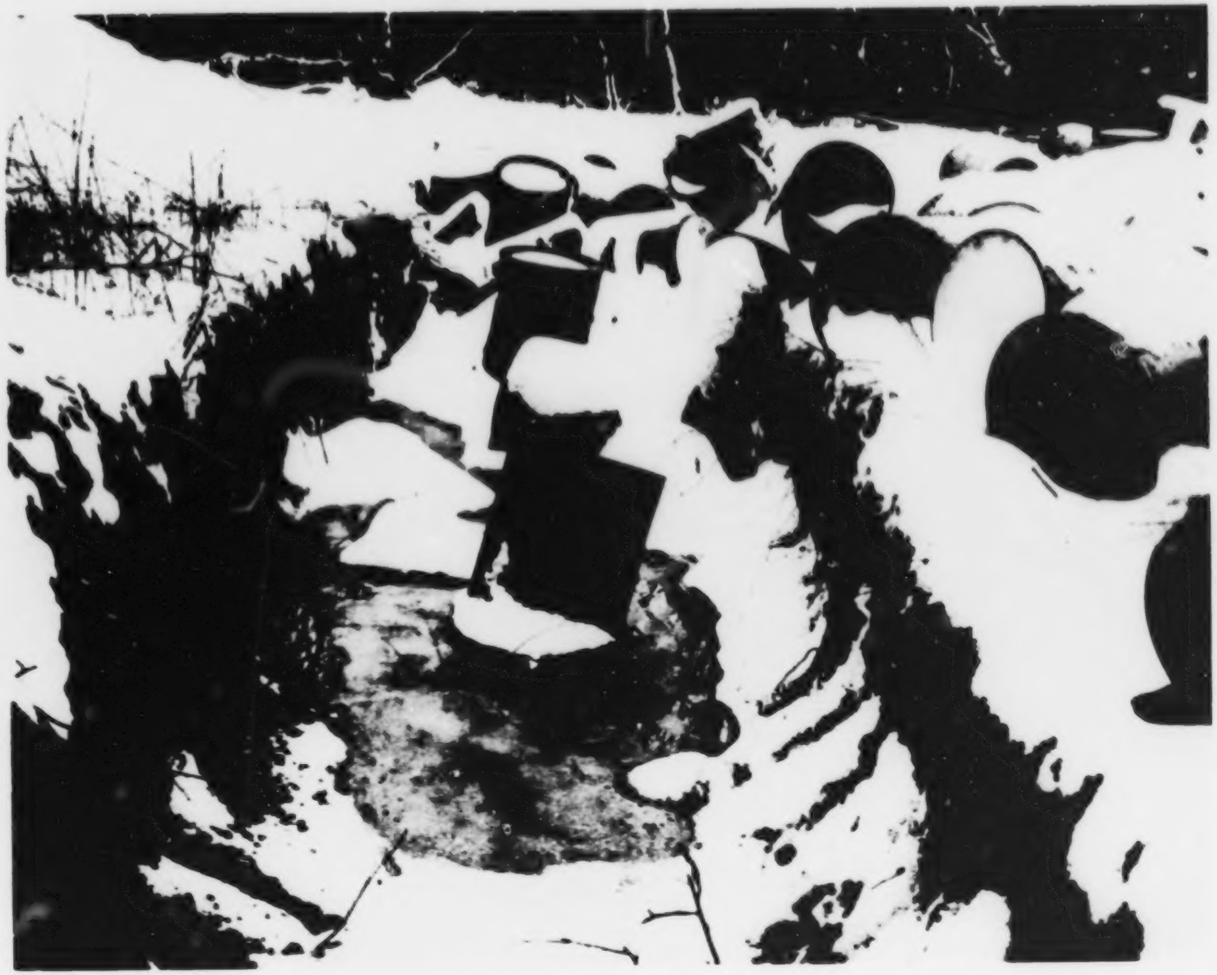

Figure 3. Discovery of Drums on the Reich Farm. (Photograph taken by Dover Township Police Dept., Jan. 30, 1972, and provided courtesy of Joseph L. Foster, Law Dept., Township of Dover)

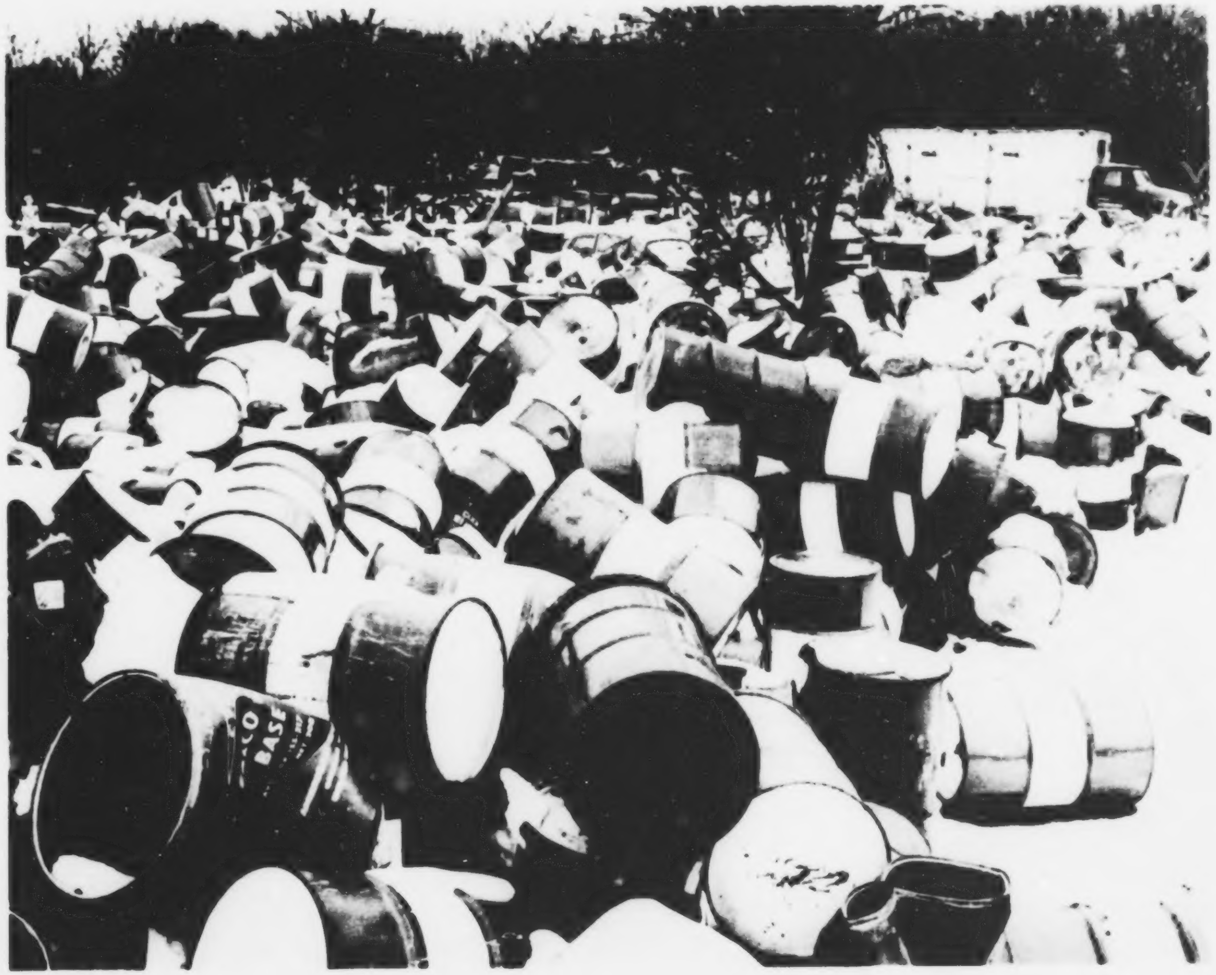

Figure 3 (Cont'd). Discovery of Drums on the Reich Farm. (Photograph taken by Dover Township Police Dept., Jan. 30, 1972, and provided courtesy of Joseph L. Foster, Law Dept., Township of Dover)

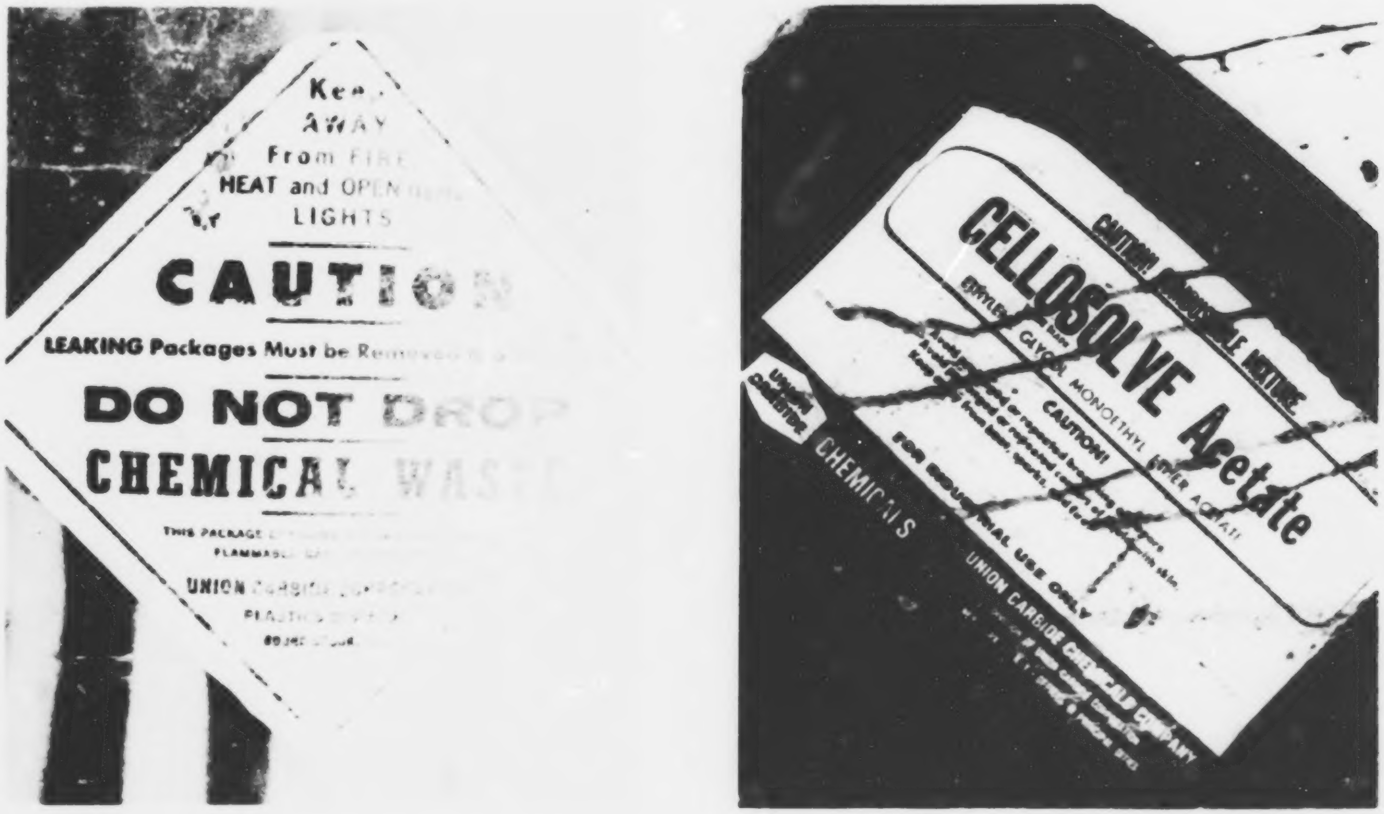
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Figure 4. Typical Identification Labels on Chemical Waste Drums on the Reich Farm. (Photograph taken by Dover Township Police Department, Jan. 30, 1972, and provided courtesy of Joseph L. Foster, Law Department, Township of Dover.)

from private property was outside the jurisdiction of the Department of Environmental Protection and the case in question should be taken up directly with Mr. Fernicola and UCC. Since in the judgment of the Reichs, a speedy affirmative action did not appear to be forthcoming from either UCC or Mr. Fernicola, the matter was turned over to an attorney to obtain a court order for the removal of the drums.

4.3 Court Cases Against UCC and Fernicola

On January 31, 1972 a complaint was filed with the Superior Court of New Jersey (Chancery Division, Ocean County) against UCC and Fernicola by Mr. Milton H. Gelzer, the attorney for Mr. and Mrs. Reich (the plaintiffs). The plaintiffs demanded judgment enjoining and restraining the defendants: (1) to forthwith remove all barrels and drums located on the property which contained materials of flammable, combustible, toxic or explosive character; (2) from continuing to deposit waste drums on the plaintiffs' premises; and (3) to provide such other relief as suitable, equitable, and just.

A second complaint, naming UCC and Fernicola as defendants, was filed on behalf of the Township of Dover and the Board of Health of the Township of Dover (the plaintiffs), by Lawrence A. Hecker, the attorney for the plaintiffs. The complaint charged that the storage of chemicals on the Reichs' property constituted public nuisance and endangered the lives and property of residents of Dover Township. On January 31, 1972 the court ordered the defendants to stop transporting or dumping any chemical wastes in the Township of Dover, and to proceed diligently with the removal of all chemical wastes and drums from the Reichs' property. In April 1972, after the drums and chemicals were apparently totally removed from the premises, the complaints against the defendants were dismissed with prejudice. In an out-of-court settlement with UCC, the Reichs received $10,000 for damages to their property and were reimbursed for the construction of a new well.*

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* Based on the interview with UCC; details of the settlement could not be obtained from the parties involved.

4.4 Removal of Chemical Wastes and Drums from the Reich Farm

Complying with the court order of January 31, 1972, UCC initiated the task of removing drums from the Reich farm. While seeking guidance from the State on enlisting services of approved waste haulers, UCC utilized the services of some of its salaried personnel from the Bound Brook plant to begin returning the drums to the Bound Brook facility. By February 5, 1972, 236 drums had been returned to the Bound Brook plant. At a meeting in Trenton on February 14, 1972,officials of the State Bureau of Solid Waste gave verbal approval to UCC to hire Astro-Pak as the contractor to sort and load the drums on trucks and to transfer them to the Price Landfill site in Pleasantville, New Jersey, for ultimate disposal. By February 16, 1972, when UCC received a telegram from the State officials indicating that "no chemical wastes should be disposed of in the Price Landfill until such time as this landfill has been registered by the Division of Environmental Quality", 440 drums had been delivered to the Price site.

Upon subsequent discussions with UCC on possible alternatives for the disposal of drums, on February 22, 1972 the State authorized UCC to transfer the drums to the UCC plant in Marietta, Ohio for the purpose of incineration, and to the Rollins-Purle waste management facility (incinerator and landfill site) in Logan Township, New Jersey. Because the incinerator at the Marietta facility could only accept low-solid liquid wastes, the drums had to be individually inspected, their contents identified and those suitable for shipment to Marietta segregated. The UCC plan called for the shipment of approximately 2,000 of the 208-liter (55-gallon) drums of liquid waste to the Marietta plant, and the hauling of approximately 2,500 of the remaining drums to the Rollins-Purle disposal site.

Tables A-2 and A-3 of Appendix A present lists and identification of the materials which were to be shipped to the Rollins-Purle facility and to the UCC Marietta plant, respectively. Based on the descriptions given in these tables, the wastes in the drums consisted of a variety of spent organic solvents (xylene, toluene, butanol, acetone, methyl ethyl ketone, methanol, isopropanol, and trichloroethylene) and tarry and polymeric residues from the production of polymers and resins. As discussed in Section 5.3, many of these wastes are considered potentially hazardous because they are flammable and/or toxic.

By February 29, 1972, 596 additional drums had been removed from the Reich farm; 78 went to the Rollins-Purle site and 518 were taken to the Marietta plant. On this date, however, UCC was advised by a State official that no more drums could be shipped to the Rollins-Purle facility because of the position taken by the Delaware River Basin Commission banning such shipments of chemical wastes.* Accordingly, the drums originally designated for shipment to the Rollins-Purle facility were instead returned to the Bound Brook plant for temporary storage and subsequent disposal in an approved manner.

The task of removing from the Reich farm the drums and the chemical wastes which had been deposited on or buried below the surface was apparently complete on March 30, 1972, when UCC and other parties involved were convinced that the premises had been completely cleared of all chemical wastes.

In June 1974, after contamination of the groundwater in Pleasant Plains was discovered and given wide publicity (Section 4.5), municipal officials in Dover Township received a "tip" that more drums might have been buried at the Reich farm that had not been uncovered during the initial cleanup operation. This assertion was subsequently verified when a site investigation uncovered 51 drums and significant quantities of chemical wastes which had been buried in certain sections of the Reich farm * (Figures 5, 6, and 7). These drums and the contaminated soil (approximately 840 cubic meters; 1,100 cubic yards) were removed and transferred to Kin-Buc Landfill (in Edison Township, New Jersey) which is owned by Scientific, Inc.†

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* Delaware River Basin Commission, headquartered in Trenton, N.J., is responsible for the protection of the Delaware River watershed. The watershed is approximately 33,700 square kilometers (13,000 square miles) in area and extends into four states: New Jersey, New York, Delaware and Pennsylvania. The restriction placed on the shipment of wastes to the Rollins-Purle facility was apparently based on the consideration of the inadequacy of the liquid waste treatment units then in operation at the Rollins Purle facility.

For several reasons, the cleanup operations at the Reich farm constituted hazardous and complicated tasks. Originally the drums were scattered over the site in a haphazard fashion (Figure 3). Scrap cars and shrub trees abounded between drums. In many cases drums weighing 136 kilograms (300 pounds) had to be carted over uneven ground before they could be loaded onto trucks. Because of prevailing adverse weather conditions, many of the drums were covered with snow and the area was generally muddy and often flooded. To segregate the drums for shipment to differenct destinations, they had to be inspected individually and their contents identified. In some cases the labels identifying the drums had been destroyed; the contents of these drums had to be determined and drums relabeled prior to shipment. In the summer of 1974, when site excavation was being conducted to uncover additional waste chemicals and drums, the odor at the site was often unbearable. There was an incident of fire aboard a loaded truck caused by waste incompatibility and seepage from one of the drums.

4.5 Groundwater Contamination in Pleasant Plains

Early in 1974, about 2 years after the discovery of chemical waste storage/disposal at the Reich farm, owners of three neighboring properties in Pleasant Plains became aware of an unusual taste and odor in their well waters. The matter was reported to the Dover Township Board of Health and

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* In addition to the 51 drums found buried at the Reich farm, municipal officials also discovered 37 drums stored in two trucks parked about 6.4 kilometers (4 miles) away (at Brookside Drive and Briar Avenue). These trucks belonged to Fernicola. At the request of Dover Township, these stored drums were also removed by Union Carbide. (See Exhibit C-9 in Appendix C for a newspaper account of the incident.)

† Some operational features of the Kin-Buc Landfill are described in a recent Hazardous Waste Disposal Damage Report published by EPA which is presented in Appendix D.

Figure 5. The Uncovering of Buried Drums at the Reich Farm. (Photograph courtesy of Mr. Al Gabriel, Superintendent of Building, Township of Dover.)

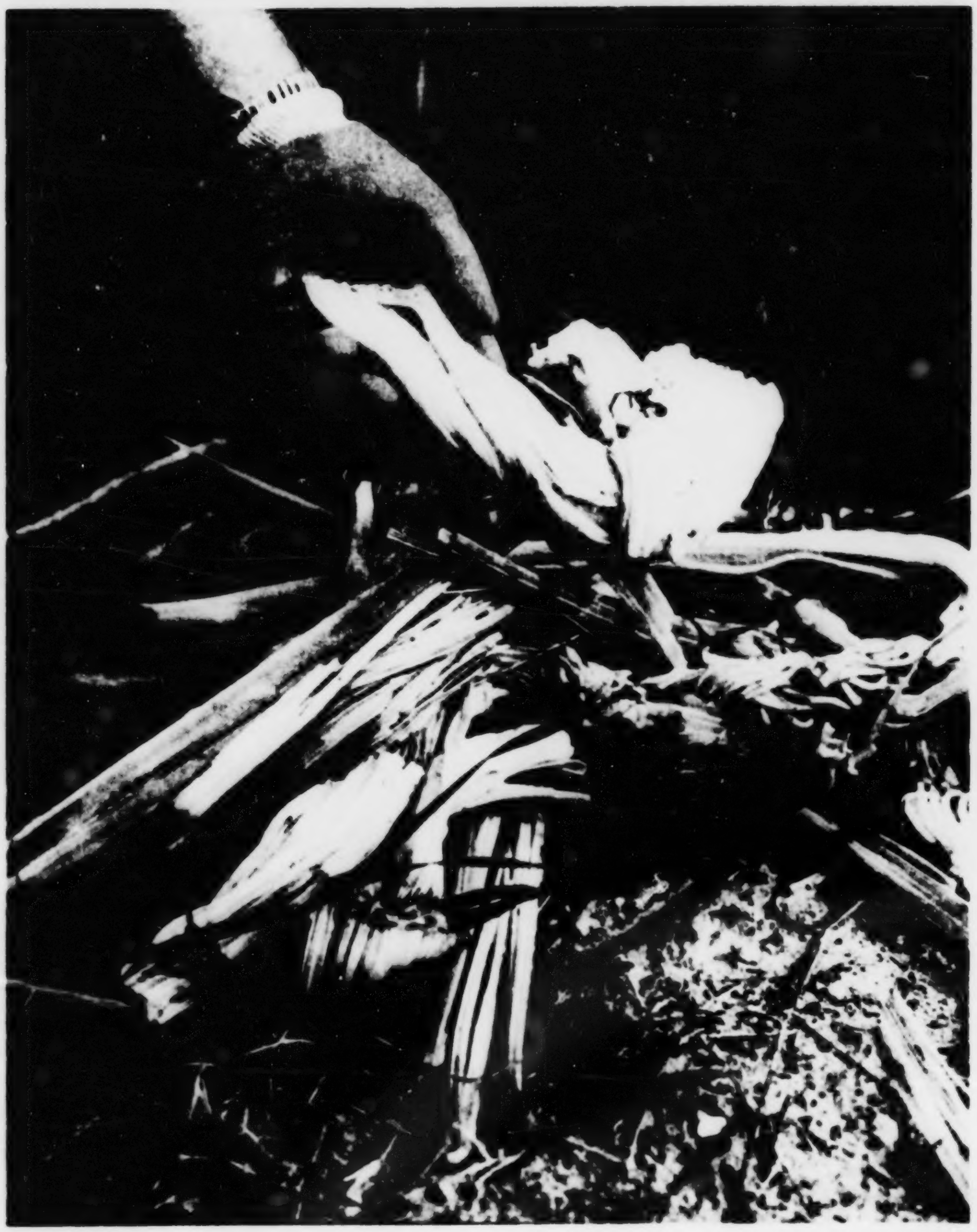

Figure 6. Typical Chemical Wastes Uncovered at the Reich Farm. (Photograph courtesy of Mr. Al Gabriel, Superintendent of Building, Township of Dover.)

Figure 7. Removal of Chemical Wastes from the Reich Farm. (Photograph courtesy of Al Gabriel, Superintendent of Building, Township of Dover.)

the property owners were advised to submit water samples to commercial laboratories for analysis. The test results indicated the presence of traces of toluene in the water from one property and phenols in the water from the other two properties. The owners of two of the properties dug new, deeper wells and found satisfactory water. The owner of the property with traces of toluene, who apparantly did not want to dig a deeper well, evicted his tenants and the property remained vacant. Sometime later, the Board of Health received a further report of "tainted" water several kilometers from the Pleasant Plains section. This property was located near the Dover Township Landfill. Laboratory tests revealed the presence of phenols in the water. The well was condemned and a deeper well was drilled to approximately 40 meters (130 feet). The Board of Health then conferred with the Ocean County Health Coordinator's office and determined that it was desirable to survey a wider area. In a letter dated June 10, 1974 to Mr. Carl Burns of the New Jersey Bureau of Water Pollution, Mrs. Matthews, then Vice-President of the Dover Township Board of Health, formally requested assistance from the Bureau in delineating and defining the extent of the groundwater contamination.

During the period of March 14 to June 17, 1974, water samples were collected by the Ocean County Health Department and submitted to the State Health Department for analysis of total organics (ether extractables). The locations sampled and the results obtained are presented in Table A-4 of Appendix A. As indicated by the data in this table, extractable organic concentrations as high as 21.3 ppm were detected in some of the water samples. There are no Federal or State standards for the presence of ether extractable organics in water supplies and it is not known how many parts per million could be injurious to one's health. However, such extractable organics are not naturally occurring and should not be in the water.

During the period of June 17 to July 30, 1974, six granular carbon "mini filters" were installed at select domestic water supplies in the area near the Reich farm and the spent carbon was sent to EPA laboratories in Cincinnati for determination of chloroform extractables. The results presented in Table A-5 of Appendix A indicated that all samples but one had carbon chloroform extract (CCE) values below 0.7 ppm, the maximum allowable

CCE level according to U.S. Public Health Service Drinking Water Standards. The sample collected from the residence of Mrs. Nelson (1532 Lakewood Road) had a CCE content of 1.2 ppm. On July 11, 1974, water samples were obtained from four different wells in Pleasant Plains and sent to the EPA Research Laboratory at Edison, New Jersey, for volatile organic analysis by a computerized gas chromatograph-mass spectrophotometer (GC/MS). The results, which are presented in Table A-6 in Appendix A, indicated the presence of toluene (12 ppb) and styrene (30 ppb) in the sample from Mrs. Nelson's residence. At a detection limit of 0.1 ppb, no volatile organics were detected in the other three samples.

On the basis of the analytical results indicated above, the very strong and persistent taste and odor problem associated with the water from some of the wells, and the documented case of waste chemical disposal on the nearby Reich farm, the Bureau of Potable Water of the New Jersey Department of Environmental Protection concluded there were sufficient reasons to suspect that the groundwater, in at least a portion of Pleasant Plains, was contaminated with hazardous organic chemicals. In a letter dated July 30, 1974, the Bureau of Potable Waters directed the Township of Dover to prohibit the drinking of water derived from certain individual wells. (The condemnation of wells and the emergency water service which was provided are discussed in the next section.)

During the period of July 31 to August 27, 1974, an extensive sampling program was undertaken whereby wells within a radius of 1.6 to 2.4 kilometers (1 to 1-1/2 miles) from the Reich farm were sampled. The water analyses were performed by the State Laboratory and by the U.S. Environmental Protection Agency's Laboratories at Edison, New Jersey. With the exception of oil and grease determinations, the analysis for total extractable organics was by the carbon tetrachloride extraction/infrared absorption (CCl_4/IR) method. The absorptivity was measured at 2930 cm^{-1} (-C-H stretch, aliphatics); the instrument was calibrated using an equivolume blend of seven components suspected to be the likely contaminants. The results of these analyses and those performed subsequently on samples collected through November 9, 1974 are summarized in Table A-7 of Appendix A. The first set of samples (collected on July 31, 1974) tested by the Edison Laboratories indicated relatively high values (6 to 68 ppm) for eight of the 20 samples analyzed. As indicated in Table A-7, however, subsequent testing of new samples by both the State and EPA laboratories failed to verify these early high readings. The results for oil and grease analysis indicated concentrations ranging from 2.0 to 13.5 ppm with the hydrocarbon content of the extracted material ranging from 6.5 to 89 percent.

Due to the nature of the soil and the shallowness of the Cohansey groundwater table aquifer, it is only safe to assume that at least some of the chemicals buried and dumped on the Reich farm and/or their biochemical degradation products reached (or will eventually reach) the groundwater. A more thorough sampling at a variety of strategic locations, followed by suitable specific chemical analysis of the samples, would be required to determine the position and movement of the contaminants in relation to the hydraulic gradient of the water table and the cones of influence for the high volume wells. Additionally, analysis of soil core samples from new test wells should also shed light on the problem. The State of New Jersey has already initiated a program of regularly monitoring the public water supply wells in the area.

4.6 Delineation of Affected Area and Condemnation of Wells

As indicated above, on July 30, 1974, the State Bureau of Potable Water directed the Township of Dover to prohibit the use of water for drinking from certain wells in Pleasant Plains. Individual wells at homes located on both sides of the following streets (see Figure A-1 of Appendix A) were specifically listed in the directive.

STREET	FROM	TO
Lakewood Road	Monroe Avenue	Church Road
Church Road	Lakewood Road	Old Freehold Road
Sunset Road	Lakewood Road	Whitesville Road
Clayton Avenue	Lakewood Road	Whitesville Road
Carolina Avenue	Clayton Avenue	Sunset Road
Monroe Avenue	Lakewood Road	Clayton Road

Following the State directive and on the grounds that groundwater contamination in Pleasant Plains constituted a serious threat to the health and welfare of the residents in the area, an ordinance to prohibit installation and use of private wells within a delineated area was introduced and passed by the Board of Health of the Township of Dover at its regular meeting on August 27, 1974. The delineated area included the wells along the streets listed above, plus additional wells along the entire length of Webster Road, Lena Avenue and Fritz Drive (see Figure A-1 of Appendix A). Overall, 148 private wells were condemned. The ordinance, which is reproduced and presented as Exhibit B-2 of Appendix B, also called for closing and capping of wells upon the introduction of a water main and public water supply to the area. The closing and capping of wells were to be at the expense of the well owners and under the supervision of the Board of Health. The proposed ordinance was submitted to a public hearing and with some modifications was adopted by the Board of Health by a unanimous vote on September 16, 1974.

In its original form, the Board of Health ordinance called for the prohibition of the use of the well water "for domestic purposes". Since domestic use was being interpreted by some to include only drinking, washing and cooking, the resolution finally adopted by the Board of Health clarified its intent by dropping the phrase "for domestic purposes" and substituting the words "for any purpose". This toughening of the language was despite a strong protest from some 50 Pleasant Plains residents who wanted to be able to continue to use their wells for watering lawns and filling swimming pools. The position of the Board was that enforcement of an ordinance permitting certain selective uses of the contaminated water would be a very difficult task and that it could not take chances on accidental drinking of the contaminated water and of possibly contaminating the new water supply with the already contaminated well water.

A second modification to the original ordinance related to the method for well closing. The "capping" method originally called for would have required the homeowners to fill the entire well casing with concrete. Such a drastic measure, involving permanent abandonment of the well, was strongly opposed by some area residents who argued for the adoption of a more temporary, simpler and less costly measure, for example, removal of the faucet or cutting off the water pipe entering a home. The residents further argued that permanent capping of wells would be a premature action and could not be justified since the extent of pollution had not yet been clearly defined and a possibility existed that the aquifer would gradually self-purify and purge itself from pollutants. Moreover, the residents felt that the ordinance was unfair to them since it denied them the opportunity to construct new wells or to extend the existing wells to the lower noncontaminated Kirkwood aquifer. The Board of Health, however, took the position that extension of the existing wells could result in the spread of contamination to the lower aquifer and that the decision to ban drilling new wells was based on State recommendations. The well closing procedure finally adopted was essentially a compromise whereby the residents were required only to "seal" their wells. The sealing method was much simpler and consisted of: (1) removal of pump, pipe and all obstructions from the well; (2) insertion of an impermeable plug at least 1.2 meters(4 feet) into the casing below the gound; (3) filling the space above the plug with concrete, cement, grout, or neat cement; and (4) after allowing 24 hours settlement, filling the top of casing with concrete and finishing off to grade. The sealing was estimated to cost $150 to $200 per well as opposed to $450 to $650 for well capping.

On December 31, 1974 the State Department of Environmental Protection published a report entitled "Final Report - Delineation of Extent of Groundwater Contamination, Pleasant Plains Section of Dover Township, Ocean County, New Jersey". This report, which followed the issuance of two earlier interim reports, culminated approximately 6 months of water testing and field studies and was claimed to represent a final delineation of the extent of contamination. Taking into account that the disposal of waste at the Reich farm was the major source of groundwater pollution, and based on the groundwater movement and available water quality data, three zones were identified which defined water quality conditions in Pleasant Plains and provided guidelines on well drilling in the area. The three zones shown in Figure 8 were described in the State report as follows:

> Zone No. I - Contaminated
>
> This zone includes those locations which were found to be contaminated and were therefore condemned as a source of water supply.
>
> Zone No. II - Questionable Area
>
> This includes those areas which, because of their location with respect to groundwater movement, are susceptible to contamination, even though the sampling may have failed to clearly demonstrate the presence of contaminants.
>
> Zone No. III - Uncontaminated
>
> Based on the information available this zone has not been nor is it likely to become contaminated.

No wells were to be installed in Zone I and all homes in this zone, including all new constructions, were to connect to the Toms River Water Company water supply service line. For Zone II it was recommended that the local health officials establish a water quality sampling and surveilance program and all new wells be installed in the lower lying Kirkwood aquifer in accordance with a set of specific procedures. Wells outside of Zone II (i.e., in Zone III) were also required to meet certain State specifications. The details of the State-recommended procedures for well installation in Dover Township are presented in Appendix B, Exhibit B-2.

4.7 Interim Emergency Water Supply for Area Residents

In June 1974, when the results of initial water sampling and analysis became known and the water testing program was being expanded to cover additional wells, a number of emergency steps were instituted to safeguard the health of the area residents and to provide them with alternate sources of potable water. (As was indicated in Section 4.6, 148 wells were condemned as a result of the ordinance passed by the Board of Health of the

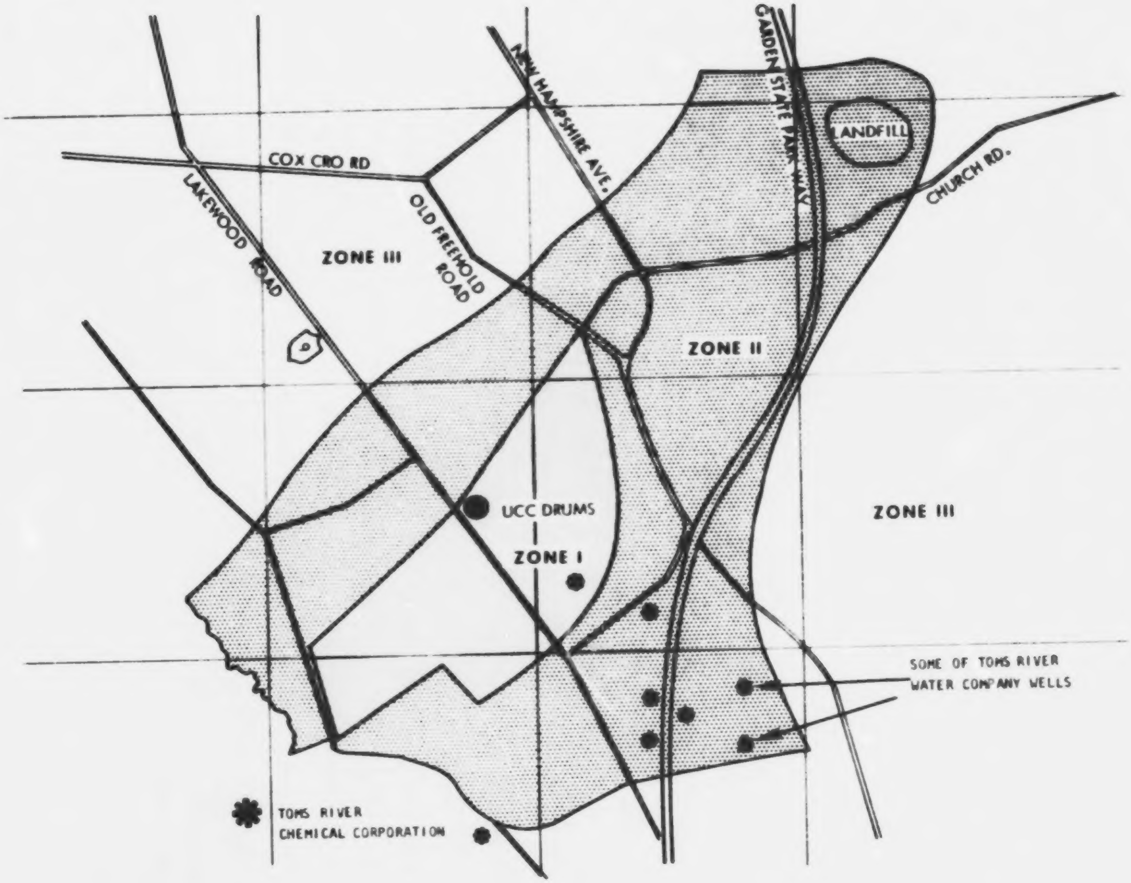
NEW HAMPSHIRE AVE.
GARDEN STATE PARKWAY
LANDFILL
CHURCH RD.
COX CRO RD
LAKEWOOD ROAD
OLD FREEHOLD ROAD
ZONE III
ZONE II
UCC DRUMS
ZONE I
ZONE III
SOME OF TOMS RIVER WATER COMPANY WELLS
TOMS RIVER CHEMICAL CORPORATION

Figure 8 Delineation of the Area of Groundwater Contamination; Zone I-Contaminated, Zone II-Questionable, Zone III-Uncontaminated

Township of Dover.) The emergency measures included using bottled water, stationing water tanker trucks in strategic locations, and modifying three water hydrants to permit water withdrawal from public supply water lines.

Many residents with contaminated wells, and some residents in adjacent areas who feared that the contaminants would soon reach their wells, began to use bottled water for drinking and cooking. For instance, early in July 1974, when officials at the North Dover Elementary School (located at Church Road and New Hampshire Avenue, see Figure A-1 of Appendix A) read newspaper accounts that the contamination of wells had spread to within 0.8 kilometer (0.5 mile) of the school, they decided not to take any chances and began using bottled water. In anticipation of the regular school opening in the fall, bottles of water were stockpiled in the school kitchen.

Responding to the request from Pleasant Plains residents and Dover Township municipal officials, the State Department of Defense (National Guard) supplied six 1,500-liter (400-gallon) water tankers which were stationed in strategic locations for use by area residents. Also, the Ocean County Civil Defense and Disaster Control provided a 28,000-liter (7,500-gallon) tanker truck to supply potable water to residents. To prevent vandalism and misuse, the tank trucks provided by the National Guard were chained to trees and the manhole covers were locked. Initially, the Civil Defense water tanker had been left unprotected and some youngsters had deposited rocks, sticks and miscellaneous objects in the tanker; there were also reports that some children had urinated in it. The tank truck had to be temporarily taken out of service, cleaned, disinfected with chlorine and equipped with a lock before being returned to the area. All emergency water tankers were periodically refilled with water supplied by the Toms River Water Company.

A third source of emergency water supply was three fire hydrants in the area which were specially modified by the Toms River Water Company so that water could be drawn from spigots. Figures 9, 10 and 11 are newspaper photographs and captions pertaining to the use of the emergency water supply in Pleasant Plains.

Figure 9. Emergency Water Supply for Area Residents - Use of Bottled Water at North Dover Elementary School

"School Officials Seek Well Water Substitute. Mrs. Margaret Moore, Principal of the North Dover Elementary School, stores bottled water in school kitchen in preparation of opening". (Asbury Park Press, Aug. 16, 1974 - Photograph courtesy of Asbury Park Press.)

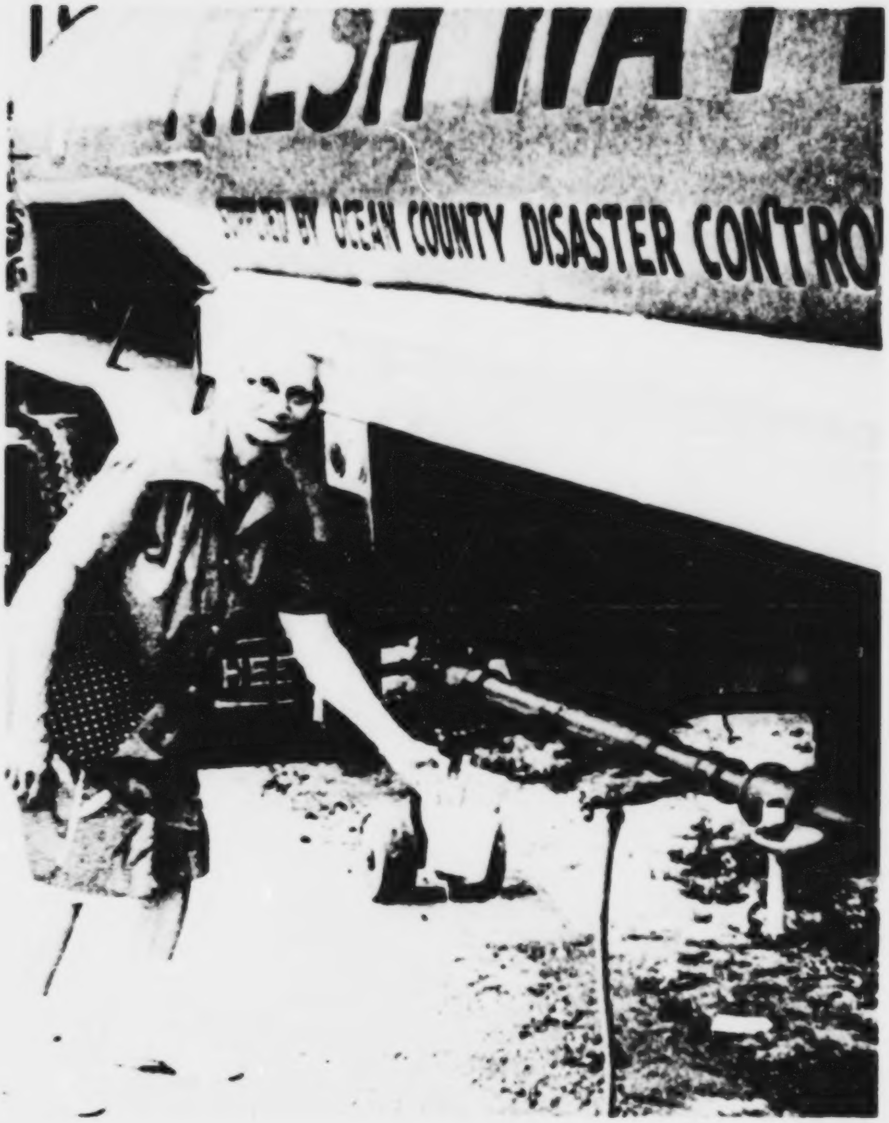

Figure 10. Emergency Water Supply for Area Residents - Tank Truck From Ocean County Disaster Control

"Mrs. Antonin Walata, 34 Clayton Avenue, Dover Township, takes fresh water from a Civil Defense tanker behind the Pleasant Plains Section of Dover, where well water is contaminated by petrochemicals". (Asbury Park Press, June 21, 1974 - Photograph courtesy of Asbury Park Press.)

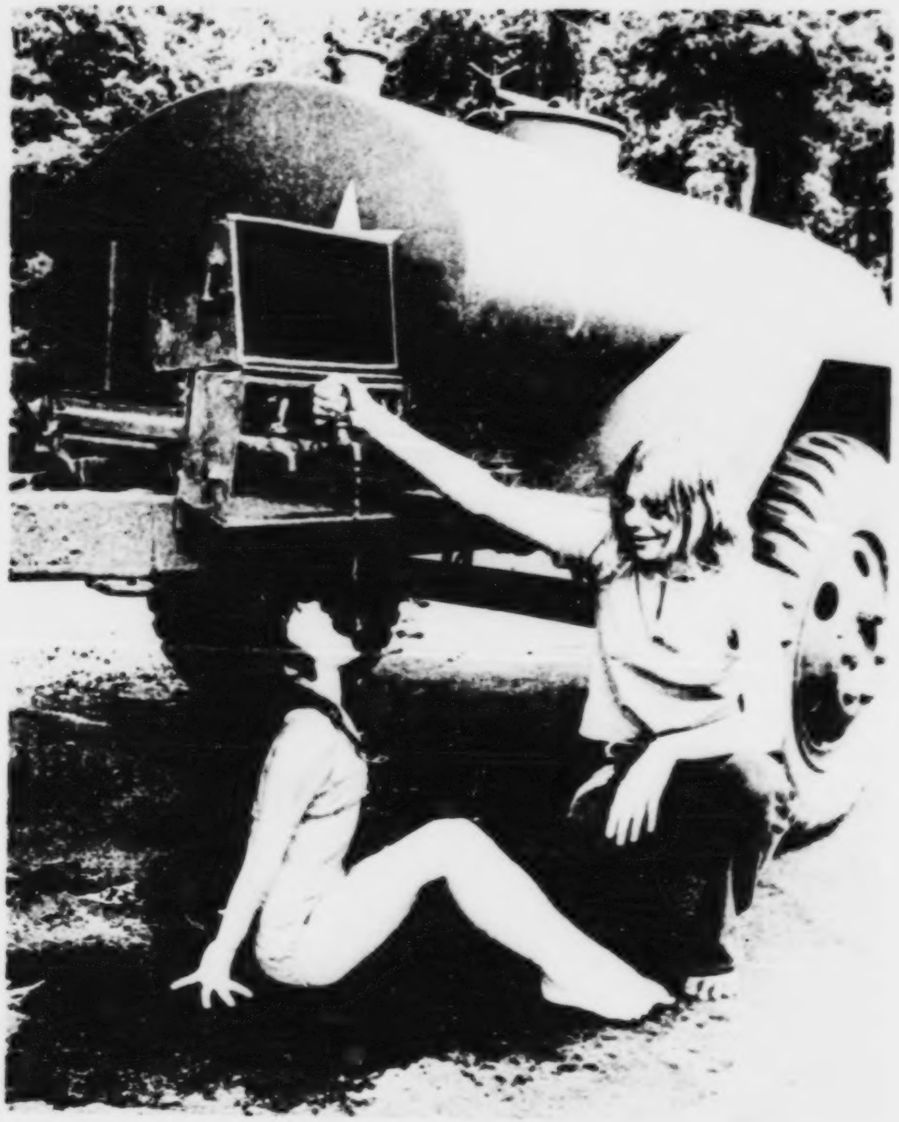

Figure 11. Emergency Water Supply for Area Residents - a National Guard Tank Truck

"Civilian Style Army Taps. Anna Smith, 8, gets a drink of water from a 400-gallon National Guard tank truck in the Pleasant Plains Section of Dover Township, with a little help from her friend, Sandy Gunnells, 14. Both girls live in the Pleasant Plains area, where well water has been found to be contaminated with petrochemicals. The State Department of Defense has supplied six 400-gallon tankers for use in the emergency". (Asbury Park Press, Aug. 1, 1974 - Photo courtesy of Asbury Park Press).

4.8 Other Interim Emergency Measures Considered

While State and local officials were investigating alternate methods to finance a permanent extension of the Toms River Water Company service lines to the area, a number of other interim measures were considered to combat contamination and secure clean water for area residents. These included the use of activated carbon filters, well drilling to the uncontaminated Kirkwood aquifer, and installation of a temporary aboveground water line delivering potable water from the Toms River Water Company supply line.

On August 21, 1974 the State published its second interim report on groundwater contamination in Dover Township. The report discussed the possibility of using activated carbon filters by individual homeowners either on an interim basis or in those instances when no other water supply was available on a permanant basis. Two types of activated carbon systems were suggested. One was a large system to be installed on the overall water supply coming into a house; the second was a small cartridge type to be installed on a sink. The estimated initial costs for the two types of filters were given at $30 to $50 for the cartridge model, and between $200 to $400 for the larger system. The purification capability of activated carbon was demonstrated by Toms River Water Co. in an experimental program.

The possibility of extracting water from the uncontaminated deeper Kirkwood aquifer was also discussed in the State's second interim report. The report made reference to an overaly map developed by the Bureau of Geology which would have enabled a qualified well driller to satisfactorily drill wells to the Kirkwood aquifer at different areas in Dover Township. Detailed instructions were also given on the technique for drilling and sealing wells to prevent contamination of the lower strata. About 20 households followed the State recommendation and drilled wells to the Kirkwood aquifer. The State report also advised affected homeowners as to where they could take their water samples for independent analysis. Three commercial laboratories were listed as having sophisticated analytical capabilities to determine organic contaminants in water samples. The cost of analysis was given as $30 per sample.

The construction of a 610-meter (2,000-feet) aboveground emergency water line to temporarily supply potable water to Pleasant Plains was considered and rejected as being impractical and not cost-effective. The emergency line was to be constructed of plastic. However, most plastic pipe suppliers indicated delivery dates in excess of 15 to 20 days. The aboveground water line was considered to be useful only until about mid-November, after which time the flow of water would have probably stopped due to freezing. Since a permanent system was being reviewed as the ultimate answer, the plan for building a temporary line was not pursued any further.

4.9 Extension of Water Service to Pleasant Plains

In a July 8, 1974 letter signed by Mr. Rocco D. Ricci, Assistant Commissioner, Department of Environmental Protection, the State conveyed its recommendation to the Township of Dover that, as quickly as is practical, a permanent municipal potable water system should be made available to those residents who own contaminated wells. On July 30, 1974, when the Township was directed by the State to prohibit the use of water for drinking purposes from certain wells, it was also advised to "proceed with the utmost dispatch to arrange for the extension of the Toms River Water Company system to serve the affected area". Such an extension of service was considered to be "the only effective and permanent solution to the problem". On August 2, 1974 Mr. John Wilford, Chief, Bureau of Potable Water, wrote to the State Department of Public Utilities informing them of the problem and requesting their help in getting water to the area as expeditiously as possible.

While the need for the extension of water service was generally recognized by most residents and public officials, there was substantial disagreement on who should bear the cost. On June 25, 1974 a proposal was introduced to a Dover Township Committee, to approve a $365,000 bond issue to finance the construction of a municipally owned system extension. The proposal, however, failed to receive a two-thirds majority vote needed for passage. Democrats who controlled the Committee 3 to 2, supported the bond issue, but the Republicans voted against it claiming that the measure had been prepared hastily and that it would be foolish to act until officials were in a position to know the true extent and gravity of the water pollution problem.

On August 2, 1974 the Township of Dover filed a petition with the Department of Public Utilities, the State Board of Public Utility Commissioners (PUC), requesting that the Board order the Toms River Water Company to extend service to Pleasant Plains. A public hearing on the matter was held on August 23, 1974 and the matter was certified for Board consideration. After consideration of the entire record, the Board found and determined that:

1) The area in question, the Pleasant Plains section of the Township of Dover, is located within the service area of respondent, Toms River Water Company.

2) Privately owned wells in the Pleasant Plains area have been found to be contaminated by the Department of Environmental Protection of the State of New Jersey.

3) An emergency condition exists, requiring an immediate extension of water service to the area.

4) Public convenience and necessity require the installation and maintenance of the proposed extension by respondent at its own expense.

Based on the above findings, on September 12, 1974 the Board ordered the Toms River Water Company to extend its facilities forthwith, at its own cost, to that area of the Township of Dover, Ocean County, known as Pleasant Plains. The Water Company agreed to comply with the Board ruling with the understanding that the residents in the area would be required to connect to its service lines and pay for the hookup cost. The Township of Dover and Ocean County also agreed to resurface roads disturbed by the installation of mains, thereby reducing the financial burden to the Water Company.

The actual work of installation of water mains and service lines lasted about one month and in November 1974 potable water was available to residents in the affected area. Based on data supplied by Toms River Water Company, the total cost for extension of water service and resurfacing of roads was $234,298 comprised of $142,567 for water mains, $15,000 for service lines, $5,000 for fire hydrants, and $71,731 for road resurfacing.

4.10 Incident Update

As of May 1975 when field interviews were conducted in connection with this investigation, the Dover Township incident was far from a forgotten case. Owners of five houses and one store (Harry and Evelyn Egloff, Timothy and Dorothy Weitzel, William and Ruth Hyres and Ernest Nagel) are bringing a suit on behalf of themselves and all others similarly situated against Union Carbide charging the defendant with negligence in its waste disposal practices. The class action and demand for jury complaint filed on October 11, 1974 charges:

> "That as a direct result of the negligent manner in which corporation or its agent deposited, stored or dumped such chemicals, the chemicals seeped into plaintiffs' groundwater and caused it to become contaminated.
>
> "As a result of the contamination of plaintiffs' groundwater, the value of the plaintiffs' real property decreased, the plaintiffs were unable to use their wells for obtaining uncontaminated water for drinking, cooking and bathing, and plaintiffs had to travel long distances to obtain water suitable for drinking, cooking, and bathing, and such water had to be carried by plaintiffs, the plaintiffs had to curtail their ordinary consumption of water, the plaintiffs were required by law to hookup into a water company's pipeline and will have to pay for such hookup and periodic payments for water consumption, plaintiffs are required by law to cap their wells at their own expense, and the plaintiffs have suffered other hardships and injury".

In connection with this complaint, the plaintiffs are asking for a total of fourteen million dollars in compensatory and punitive damages. As of May 21, 1975, UCC had been served the complaint and the interrogatory, and the company was preparing its response to the interrogatory.*

Most recently, the State Department of Environmental Protection filed suit against UCC charging the company with polluting the public water supply in the Pleasant Plains section of Dover Township by improperly disposing of liquid chemical wastes. The complaint, a copy of which is included in Appendix C, (Exhibit C-5) was filed on December 18, 1975, and names UCC and Fernicola as defendants. Since the filing of the State complaint, the attorneys involved in the above-mentioned private suit against UCC have agreed to let the State suit take precedence; i.e., the citizens class action suit may or may not come to court pending the outcome of the State suit.

The exact source or sources of groundwater contamination in Dover Township have not been established with certainty and the location of a "mass" of hazardous chemicals, believed by some to be "floating" underground, is not known -- if indeed such a mass of chemicals exist. There currently remains a considerable amount of dissatisfaction on the part of the Pleasant Plains residents who have been compelled to abandon their wells. With the exception of a few cases, homes in the affected area have connected to the Toms River Water Company service lines. As far as it could be determined, the well sealing ordinance has, in general, been ignored.†

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* According to a more recent account (Asbury Park Press, Dec. 19, 1975), this private suit has not come to court yet, and the attorney for the plaintiffs is in the process of adding additional families as plaintiffs. The attorney is also quoted as saying that during the summer of 1975, UCC had discussed the possibility of an out-of-court settlement but no agreement was reached.

† In a telephone conversation on March 10, 1976 with Mrs. Matthews, ex-president of the Dover Township Board of Health, Mrs. Matthews indicated that as yet many residents have failed to comply with the well sealing ordinance. Some residents have refused to let inspectors from the Board of Health enter their properties to inspect the wells. The matter has been taken to court by the Dover Township prosecutor.

Despite its unfortunate nature, the Dover Township incident has had several important benefits. There is now a greater awareness on the part of the public to potential adverse environmental effects which can result from mismanagement of industrial wastes. The State has initiated a hazardous waste management program and will soon require all landfills accepting chemical wastes to meet certain State requirements. The State is continuing a regular water quality sampling and surveilance program in the Dover Township area. Twelve observation wells are sampled on a quarterly interval. Three observation wells have been installed around the Dover Township Landfill; leachate formation has been observed and samples of the leachate are being tested for gross physical and biochemical characteristics. Toms River Water Company is currently keeping a close watch on the quality of its raw water, especially that derived from wells located in the Cohansey aquifer. The company has also conducted a preliminary cost assessment for the installation of an activated carbon system for use in the event that contaminants are detected in the company's wells.

A brief review of some of the above-mentioned recent developments are included in the following section on Analysis and Discussion of Findings.

5.0 ANALYSIS AND DISCUSSION OF FINDINGS

5.1 Potential Source(s) of Groundwater Contamination

5.1.1 Reich Farm and Dover Township Landfill

As discussed in Section 4.6, the decision to condemn wells in Pleasant Plains was based primarily on the severe taste and odor problems associated with waters from certain wells, a limited amount of water quality data which indicated the presence of a small concentration of general organic contaminants in some of the wells and styrene and toluene in one of the wells, and the documented case of waste chemical storage and burial on the nearby Reich farm. Due to the extremely hazardous nature of some of the chemicals in the UCC wastes (see Section 5.3, below), the situation had to be considered very grave and the use of well water banned in order to safeguard the health and well-being of the area residents.

As additional water quality data became available, the numerical value of each test result was placed on a map by the location of the well from which the sample originated. When the map was superimposed on an elevation contour plot for the Cohansey water table (Figure 12), no definite correlation could be established at that time between the distribution of organics in the wells relative to the location of the Reich farm and the southeasterly direction of the groundwater movement. Since the pumpage from the wells in the area had generally been small, the haphazardness of the concentration distribution could not be attributed to a dispersion phenomenon brought about by well drawdowns and the formation of cones of depression; however, this randomness might be explained by local directional deviations in lithologic sub-units of the Cohansey Formation. In some instances wells located farthest from the Reich farm showed a higher concentration of organics than nearby wells. Since some of these high concentration wells were in the vicinity of Dover Township Landfill, the landfill was suspected as an additional possible source of contamination. This seemed to be justified in light of alleged disposal of chemical wastes from UCC and possibly other companies in the landfill by Fernicola and probably other waste haulers. (See Exhibit C-2, Appendix C for a copy of an affidavit by Mr. Richard Winton, a truck driver for Mr. Fernicola, indicating disposal of chemical wastes into Dover Township Municipal Landfill.) The observation wells which have since been installed around

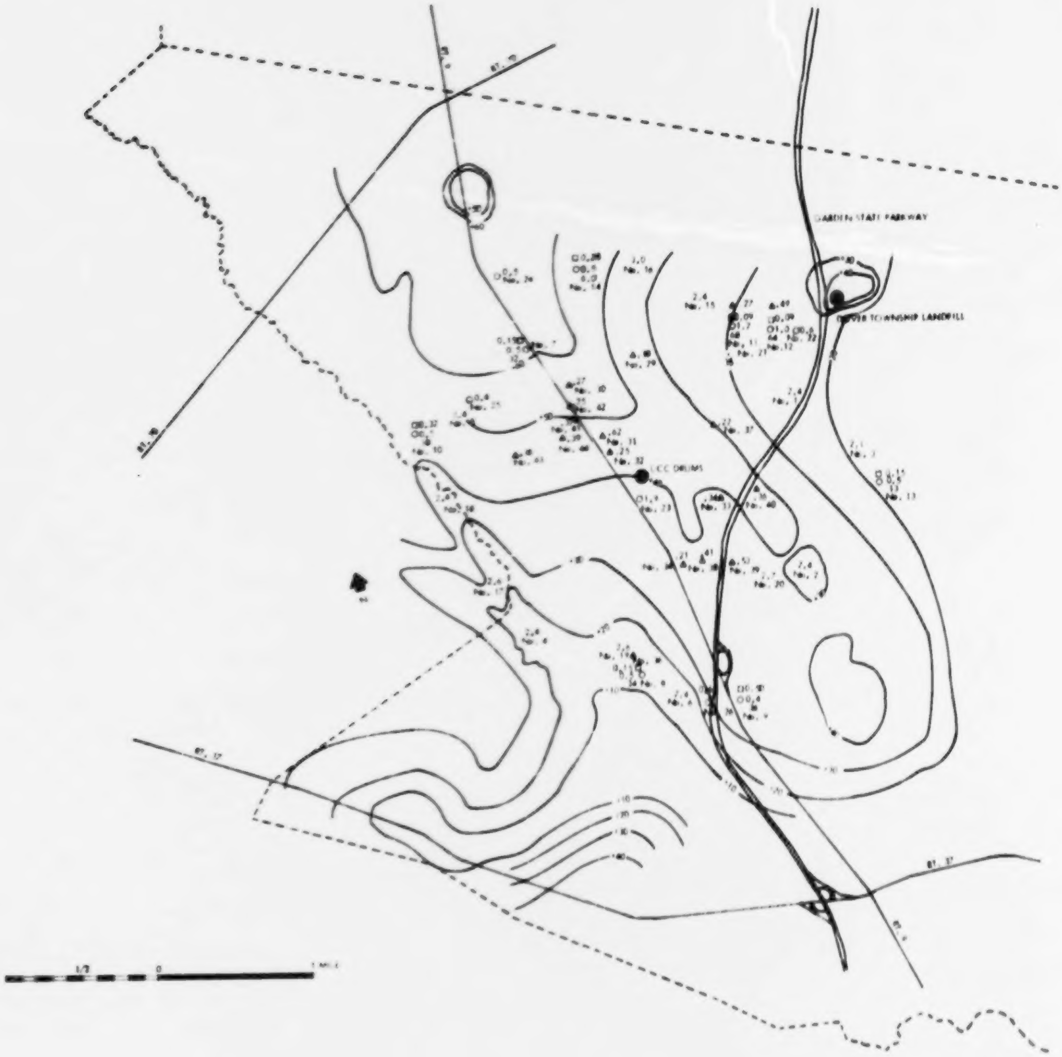
GARDEN STATE PARKWAY
DOVER TOWNSHIP LANDFILL
CCC DRUMS

Figure 12 Overlay Map Showing the Measured Concentration of Organics (ppm) in the Wells Sampled in Relation to the Groundwater Table Elevation Contour (Contour intervals 10 feet; Map courtesy of Mr. Frank Markowicz, State of New Jersey, Department of Environmental Protection.)

this landfill have revealed formation of leachates, some of which undoubtedly reach the groundwater. However, according to New Jersey Department of Environmental Protection hydrogeologists who have investigated the Pleasant Plains groundwater contamination problem, the Dover Township Landfill is an unlikely contributing factor, based on the direction of groundwater flow. Because of the very complex chemical makeup of landfill leachates, and the changes which the organics undergo in a landfill, it would be an extremely difficult, if not impossible, task to draw conclusions as to the origin and fate of specific components in the leachate.

5.1.2 Toms River Chemical Corporation

A number of individuals interviewed during the field investigation indicated that in their judgment Toms River Chemical Corporation (TRC) has been and is a major contributor to the groundwater contamination in the area southwest of the Reich farm. The following three paragraphs present a brief description of the TRC operation, based on discussions with Mr. William Bobsein, Manager of TRC's Environmental Technology Department.

TRC employs about 1,300 people and is the largest civilian employer in Ocean County. TRC is owned by two Swiss companies, with Ciba Giegy holding about 80 percent of TRC's stock. The facility is located in Dover Township west of the Garden State Parkway and north of State Highway 37 (see map in Figure 2). TRC's principal products are organic synthetic dyes, which account for 15 to 20 percent of the U.S. production, and epoxy resins. Under a State permit originally issued in July 1970, and subsequently renewed each year, TRC uses an on-site landfill for the disposal of "nonincinerable" process wastes (waste product epoxy, chemical sludges, still bottoms, etc.). The landfill covers a 91- x 91-meter (300- x 300-foot) area of which a 55- x 50-meter (180- x 165-foot) section has been utilized. The waste is containerized in steel drums (some of which are lined) prior to deposition in the landfill. The surface and subsurface soil is a sandy material and the landfill is not lined. Each lift is covered with about 1.2 meters (4 feet) of dirt. Current operation of the landfill is at the third lift. Each waste drum carries an identification tag and its content is documented. Each year TRC submits a report to the State on the quantity and general characteristics of the material landfilled. On a dry basis, the total quantity of waste deposited in the landfill in 1974 was 1,782 metric tons (1,916 tons). Under the new State regulations, which were expected to become effective September 15, 1975 (Section 5.6), no chemical wastes would be allowed in a landfill unless the landfill is properly lined and provided with a leachate collection/treatment system. At the time of the field interviews (May 1975) TRC was in the process of designing a new landfill which would meet the State requirements. This landfill was expected to become operational on or before September 15, 1975.

All "incinerable" chemicals (contaminated solvents, tars, still bottoms residues, etc.) generated at TRC's facility are hauled away by Rollins Environmental Services and incinerated at the Rollins facility in Logan Township, N.J. Trash consisting essentially of noncontaminated solid wastes (paper bag, office waste paper, etc.) are compacted on site and hauled away by Freehold Cartage Inc. to Lone Pine Landfill in Freehold Township, N.J. The formal contracts with the two disposal companies are very specific as to the manner in which the waste must be handled and disposed of. TRC investigated several waste disposal contractors before selecting Rollins Environmental Services and Freehold Cartage Inc.. TRC does not feel that its responsibility for proper disposal of waste terminates once it has selected an off-site contractor for waste disposal.

All industrial liquid wastes from TRC's facility are handled in a treatment system consisting of neutralization with dolomitic quick lime, gravity sedimentation (for the removal of $CaSO_4$ precipitates), and biological treatment in an aerated lagoon. Approximately 15,000 cubic meters (4,000,000 gallons) of wastewater are handled each day in this treatment system. The raw wastewater is very low in pH with average BOD and TOC values of about 600 and 300 mg/l, respectively. The effluent has a BOD of 300 mg/l and is discharged through an ocean outfall. Bioassay tests and dispersion studies have indicated no significant adverse environmental effect in the general vicinity of the ocean outfall. TRC has designed a new activated sludge waste treatment plant which is expected to become operational by July 1, 1977. The cost for the new system is estimated at $15,000,000. The new treatment plant is designed to meet the effluent discharge limitations specified in the permit to be issued under the National Pollution Discharge Elimination System (NPDES) permit program.

TRC's facility in Toms River has been in operation since 1952. The aerated lagoon and the sedimentation basins currently in use are not lined and, considering the somewhat porous nature of the soil, it is conceivable that they might be sources of groundwater contamination. According to one report*, prior to the installation of an ocean outfall, TRC wastewaters were settled in overflowing lagoons which were later abandoned and covered. The buried material may produce leachates which can conceivably enter the groundwater. During 1960 to 1970, 12 test holes were drilled on TRC property. According to Mr. William Enderson, a well driller who participated in the drilling effort, a strong "shoe polish" odor (presumably due to nitrobenzene) was observed in most of the test holes. This same odor was observed in the test holes which were drilled during January to February 1975 in the vicinity immediately outside of the TRC facility. The "shoe polish" odor is reportedly also observed in that stretch of the Toms River adjacent to the TRC facility.

Allegations and assertions that the TRC facility is a major source of groundwater contamination in Pleasant Plains are generally contradicted by data and findings which have been presented by TRC and the State. According to TRC (letter from Mr. W. P. Bobsein to Mr. Howard Wiseman of State Department of Environmental Protection, dated November 15, 1974), TRC has periodically analyzed water from its wells and found it to meet the State criteria for potable water supply. In its December 31, 1974 final report on the "Delineation of Extent of Groundwater Contamination, Pleasant Plains Section of Dover Township, Ocean County, New Jersey," the State concluded that based on review of the water table data and the analytical results for water samples from TRC production wells, the Toms River, and several probe holes constructed along the Toms River, "it does not appear that Toms River Chemical Corporation is contributing to the problem in Pleasant Plains".

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* A letter written to TRW (dated May 14, 1975) by Mr. Bernard Mackle (Mackle Associates, 126 Hooper Avenue, Toms River, New Jersey).

5.1.3 Other Possible Sources of Groundwater Contamination

A number of individuals interviewed during the field investigations conveyed allegations indicating numerous instances of illegal land disposal of chemical wastes at various locations in Dover Township and adjacent jurisdictions. Although these possible sources of groundwater contamination relate to the Cohansey Formation, they do not appear to bear on the Pleasant Plains problem directly, according to hydrogeologists of the New Jersey Department of Environmental Protection. Some of the allegations cannot be adequately supported by factual data; however, a number of them were made by public officials and were well documented. Exhibit C-6 (Appendix C) is a copy of the letter from Mr. Kauffman of the Ocean County Health Department to the State Department of Environmental Protection in which a number of specific locations are identified as sites where allegedly illegal waste disposals have taken place. Also included in Appendix C are two newspaper accounts on the discovery of chemical wastes in two illegal disposal sites (Exhibits C-7 and C-8).

5.2 Water Quality Data

As was discussed in Section 4.6, the decision to condemn wells in a section of Pleasant Plains and to extend the services of Toms River Water Company to the area was prompted by, and to a large extent based on the initial analytical results which indicated the presence of organics in well water samples. Given the suspected source of contamination, namely the storage/disposal of hazardous chemical wastes on the nearby Reich farm, the decision to condemn wells and to seek a source of public water supply was considered to be in the best interest of the area residents whose health and safety were judged to be in jeopardy by the local Board of Health. The action to condemn wells, however, was criticized by some well owners. The critics of the Board of Health's action based their objections on two grounds. Firstly, they felt that the water quality zones described in Section 4.6 had been established somewhat arbitrarily. Secondly, there appeared to be a number of inconsistencies in the water quality data. The purpose of this section is to briefly discuss the basis for the controversy involving the water quality data.

The State, in its first round of well water sampling, used a standard method for determining oil and grease content.* As indicated by the data in Tables A-4 and A-7, the values obtained ranged from 10 to 22 mg/l. UCC also tested a number of samples for oil and grease content by another standard method.† UCC's results were somewhat lower, values generally ranging between 2 and 10 mg/l, with several higher than 10 mg/l (the highest value was 25 mg/l). However, using a supposedly clean sample (Toms River Water Company Well No. 20), UCC reported a value of 15 mg/l, and when UCC technicians tested four samples of distilled water, oil and grease values ranging from 1 to 6 mg/l were obtained. Therefore, a UCC report on the analysis of water samples (Report 910E10, July 27, 1974) concluded that while all well water samples from Dover Township showed the presence of organics, the results were inconclusive because of the variability of the tests and analyses at the lower detectable limits of the method. Both the State's and UCC's efforts to identify the specific compounds present in analytical extracts were unsuccessful, other than tentative identification by UCC of ester and ether linkages and some low molecular weight alkyl groups.

State officials have defended the method used by citing work done at their own laboratory in connection with the establishment of an oil and grease sewage effluent standard. The work indicated that reproducible results can be obtained at low levels and that the 5 mg/l level can be looked upon as a meaningful result both in terms of its accuracy and its significance in potable waters.

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* Standard Methods for the Examination of Water and Wastewater, Thirteenth Edition, Method 209 D, p. 413.

† Ibid., Method 137, p. 254

Because of the controversy involving the "oil and grease tests", a method for determining total organic content involving carbon tetrachloride extraction/infrared absorption was employed in another round of water sampling and analyses, with the technical assistance of the U.S. EPA (Table A-7, Appendix A). The values obtained in the first set of samples taken on July 31, 1974, ranged from 2.1 to 68 mg/l. While the highest values were not consistent with those obtained in subsequent rounds of sampling, a significant number of later analyses indicated greater than 1 ppm total organic extractables. According to Dr. Francis Brezenski, Chief of Laboratories for EPA Region II, there are currently no official standards for the acceptable level of organics in potable waters; however, values greater than 1.0 ppm obtained by this method are significant and constitute sufficient reason for suspicion of organic contamination.

Perhaps the strongest analytical evidence for the presence of specific organic contaminants in the water samples are those obtained by the EPA Laboratory at Edison, N.J., using a computerized gas chromatograph-mass spectrometer system. Toluene (12 ppb) and styrene (30 ppb) were confirmed in one sample of water from a well at Mrs. Nelson's residence (see Table A-6, Appendix A). From the standpoint of taste, odor and apparent color, this particular well appeared to be the most adversely polluted one in Pleasant Plains. As indicated in Table A-5 (Appendix A), the water from this well also had a carbon chloroform extract (CCE) value of 1.2 ppm which exceeded the 0.7 ppm maximum recommended level under the U.S. Public Health Service Drinking Water Standards.

5.3 Hazardous Characteristics of UCC Wastes

Regardless of whether or not chemical wastes from UCC were responsible for the contamination of the groundwater in Pleasant Plains, the manner in which the wastes were handled was improper and presented a potential hazard to lives and property of residents in Dover Township and other townships where wastes were deposited and/or through which wastes were transported.

Based on the general description of the wastes (Tables A-2 and A-3, Appendix A), some of the waste drums contained toxic and flammable material, thereby requiring extreme caution in handling, transporting, storing and disposal. The civil action suit brought against UCC and Mr. Fernicola by the Township of Dover and the Board of Health of the Township of Dover charged that the UCC wastes were transported in trucks not properly marked or labeled, in violation of applicable local and State law. The indiscriminate surface storage and careless piling of thousands of drums containing hazardous chemicals at the Reich farm constituted a fire hazard and posed a serious threat to the safety and well-being of area residents who were totally unaware of the danger which existed nearby. (See Exhibit C-4, Appendix C, for an affidavit signed by Mr. David Ascione, Fire Chief of Pleasant Plains Fire Company.) Because of their hazardous nature, the wastes should have been disposed of in an environmentally acceptable manner (e.g., by controlled incineration, encapsulation, and/or disposal in chemical landfills suitable for containment and disposal of hazardous wastes). The disposal and burial of wastes at the Reich farm and at sanitary landfills constituted potential for groundwater pollution, property damage, and injuries to landfill operators. A fire which occurred at the Dover Township Landfill has been attributed to the disposal of hazardous chemicals. (See Exhibit C-1, Appendix C, for an affidavit signed by Robert Brune, then Mayor of the Township of Dover.)

Tables A-2 and A-3 (Appendix A) present the data supplied by UCC on the content of the drums removed from the Reich farm. In many cases the descriptions of the wastes are very general (e.g., "tar pitch", "lab waste solvents", "blend of resin and oil", "solvent washes of process equipment", etc.) and do not identify the specific chemical constituents of the waste material. Accordingly, for these wastes no quantitative data can be extracted from the published literature on their toxicity, flammability, and other hazardous characteristics. The labels assigned to some of the waste drums are nevertheless indicative of their flammable (red label), oxidizing (yellow label), corrosive (C.L. label), and poisonous (P.L. label) contents.

Based on hazard evaluation criteria developed by the National Academy of Sciences (Appendix A), 15 of the individual chemicals identified in the UCC wastes were rated as to their hazards in 10 different hazard categories: fire, vapor irritant, liquid/solid irritant, poisons, human toxicity, aquatic toxicity, aesthetic effects, reactivity with other chemicals, reactivity with water, and self-reaction. The results presented in Table A-9 (Appendix A) indicate that, with the exception of two chemicals (chloroethylene and dichlorobenzene), all chemicals listed have a rating of Grade 3 (highly hazardous) from the standpoint of fire hazard. Acrylonitrile and epichlorohydrin are rated as Grade 4 (extremely hazardous) with regard to human toxicity and poison hazard, respectively. These two chemicals and some of the others shown in the table are rated as Grade 3 or Grade 2 with respect to a number of other hazard categories.

The New Jersey State Bureau of Solid Waste Management recently published a preliminary list of hazardous wastes and identification codes. With the exception of monochlorobenzene and methyl ethyl ketone, all chemicals listed in Table A-9 (Appendix A) as individual identifiable components of UCC wastes are included in the State Hazardous Waste List.

The ratio of the 5-day biochemical oxygen demand (BOD_5) to the theoretical total oxygen demand is commonly used as a "biodegradability index" to judge the persistence of a substance in the environment.* Any substance with an index less than 20 percent is considered to be environmentally persistent. The following are biodegradability index values reported for some of the chemicals listed in Table A-9 (Appendix A).*

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* Biochemical oxygen demand (BOD) is the amount of oxygen required by bacteria for the stabilization of organic waste material. A standard BOD test is run for 5 days at 20°C. The biodegradability index, as defined here, is the ratio of the BOD_5 to the amount of oxygen which would be theoretically required for the complete stabilization of organic wastes, expressed as percent.

Chemical	Biodegradability Index, % (BOD_5/Theoretical Oxygen Demand)
Acetone	37
Acrylonitrile	0
Ethanol	76
Isopropanol	7
Methanol	75
Methyl Ethyl Ketone	74
Toluene	28

The above data indicate that some of the individual compounds identified as constituents of the UCC wastes are not readily biodegradable (acrylonitrile and isopropanol) and would be expected to persist in the environment (groundwater, soil) for an appreciable length of time. Based on the generic description of the waste in Tables A-2 and A-3 (Appendix A), many of the UCC wastes are polymeric resinous materials which in general would not be readily biodegradable and hence would be environmentally persistent.

5.4 Health Implications

Although some of the specific chemicals which were present in the UCC wastes are known to be toxic and could have posed a serious health hazard if taken internally via consumption of contaminated groundwater, the use of potentially contaminated groundwater in Pleasant Plains did not result in substantiated and medically documented cases of human illness in the area. However, the possiblity of chronic health effects could not be evaluated.

When the incident in Pleasant Plains first became public, there were strongly voiced fears as to the possible health effects of the chemicals in the water. In a news item which appeared in the June 10, 1974 issue of the Trenton Times, comments were attributed to John Wilford, Chief of the State Bureau of Potable Water, indicating that "the contaminants present in the groundwater could possibly be cancer-causing substances and chemicals that can, when taken in high concentrations, cause paralysis". The article went on to say that Mr. Wilford "has condemned Dover Township and Ocean County health officials for waiting six days before notifying 27 families that the wells for their homes had been contaminated by potentially hazardous petrochemicals". (Note: Mr. Wilford denied that he had ever made such comments and referred to the newspaper story as "a 'good' example of irresponsible journalism".*)

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* Based on data provided in the following two references:

"Preliminary Investigation Requirements - Petrochemical and Refinery Waste Treatment Facilities", Report Prepared by Engineering Science, Inc./Texas for the Water Quality Office, EPA, Project 120 20EID, Mar.1971

"Water Quality Characteristics of Hazardous Materials, Texas A&M University, 1974", Hann, R. W., and Jensen, P. A..

In June 1974, an "illness survey" was conducted in Pleasant Plains by the Disease Control Section of Ocean County. The objective of the survey was to investigate the possible correlation between the reported concentration of organics (extractable "petrochemicals") in the well waters and cases of illness and medical complaints. The area surveyed covered 10 wells for which analytical results had indicated the presence of petrochemical pollutants, four wells for which test results had indicated no petrochemical pollutants, and nine wells for which no analytical results were available. Twenty-three families comprised of 48 persons were interviewed at random throughout the Pleasant Plains area. Fifteen families reported illness of some sort involving kidneys, stomach, liver, and gallbladder, while eight families had no illness. The survey indicated illness in families whose wells tested positive or negative for petrochemicals as well as in families whose wells were not tested. Accordingly, based on the survey results, no correlation could be established between the use of contaminated well water and the reported illnesses.

Most other claims of illness could not be medically documented. A reporter for the Asbury Park Press once received a telephone call from a housewife in Pleasant Plains who claimed that she was ill, and according to her doctor her illness was caused by the presence of contaminant organics in the well water. The reporter indicated to the caller that if she obtained a letter from her doctor supporting her claim, he would be very happy to publish the letter in his newspaper. After this exchange, however, the reporter did not hear from the caller again. At one time the children in one family were reported to have developed body rash which disappeared when they stopped using well water. This report could not be medically verified either. The field investigation conducted in connection with this report included telephone interviews with two physicians who had had patients from the Pleasant Plains area. Dr. Jassie, a urologist, indicated that nothing had come to his personal attention involving urinary infection resulting from groundwater contamination. Dr. Sawyer, the second physician interviewed, knew of no complaints from his patients regarding any illness which may have resulted from groundwater contamination.

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* Memo written by Mr. John Wilford to Commissioner David J. Bardin, June 11, 1974.

Some of the residents of Pleasant Plains who were contacted during the field interviews indicated a deep concern over possible long-term health implication of trace contaminants which may be present in their potable water supply. Two residents whose wives were expecting babies expressed worry about possible adverse effect of groundwater on the development of their unborn children. Appendix E makes reference to similar health-related concerns expressed by area residents.

5.5 Economic Damage

For discussion purposes, the economic aspects of the Dover Township incident may be considered to include the following elements:

1) Direct damage costs
2) Health and safety protection costs
3) Indirect costs
4) Comparative abatement costs

The direct damage costs represent the actual economic damages incurred as a direct result of the incident. The major item in this category is the cost of the cleanup operation, i.e., removal of the drums from the Reich farm and excavation and removal of the wastes buried at the site.

The health and safety protection costs are those actually incurred in warding off the adverse impact of the incident. Major items in this category include costs associated with the use of bottled water and tanker trucks, water quality sampling and analysis, installation of observation wells, and extension of the public water supply to the area.

The indirect costs represent the administrative costs incurred in the cleanup effort and implementation of corrective actions, the litigation costs, and "costs" which may be assigned to the denial of the privilege to use private wells, personal inconvenience, and devaluation of property.

The comparative abatement costs represent those which would have been incurred if the wastes had been treated and disposed of in an environmentally acceptable manner.

The following sections present and discuss the cost data for the major items in the above-listed categories. The cost data presented for various items are either those which were directly obtained from the individuals interviewed during the field investigations, or are estimated from the information supplied by those interviewed.

5.5.1 Direct Damage Costs

Table 1 presents a summary of the major cost items in this category. The unit price value for the first item was supplied by Mr. William Endreson, a well driller. The cost for removal of the 4,500 drums discovered at the Reich farm is estimated at $3.50 per drum (i.e., the same fee that UCC paid Fernicola to remove drums from its Bound Brook Plant). The $10,000 cleanup cost to Dover Township is that estimated by Mr. A. Gabriel, Superintendent of Building, Township of Dover. Based on the items included in this table, the total estimated direct damage cost associated with the Dover Township incident is $70,150. It should be noted that this cost does not include any damages which may surface in the future if the contaminants originating from the wastes deposited at the Reich farm or elsewhere in the general area spread and reach other private wells or the production wells of Toms River Water Company.* Toms River Water Company's investment in the

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* In a telephone discussion with Mr. Charles Kauffman of the Ocean County Health Department on March 12, 1976, Mr. Kauffman indicated that the owners of 18 properties along Dugan Lane and Wallack Drive in Pleasant Plains (see Figure 2) have signed a petition requesting extention of the Toms River Water Company supply line to their properties. The property owners claim that their wells have developed objectionable taste and odor. The Ocean County Health Department has sampled 12 wells in the area. Analysis of the water samples by an independent laboratory has indicated the presence of phenol ranging from 0.4 to 4 ppm in six of the 12 wells sampled.

TABLE 1. SUMMARY OF DIRECT DAMAGE COSTS *

Item	Estimated Cost, $
Capping of the 148 condemned wells, estimated at $300 per well†	$ 44,400
Removal of 4,500 drums from the Reich farm, estimated at $3.50 per drum	15,750
Estimated manpower cost to Dover Township for inspection and removal of buried waste at the Reich farm	10,000
TOTAL	$ 70,150

* For two reasons, the replacement value of the 148 wells condemned (estimated at a total of $148,000) was not considered as an item of direct damage cost. First, the residents were supplied with an alternate source of water (Toms River Water Company supply), the cost of which is included in the Health and Safety Protection Costs (Section 5.5.2); second, in many cases, at the time when the wells were condemed, the salvage values of the capital originally invested in the wells were small.

† As of May 1975, the ordinance requiring the capping of condemned wells was generally ignored by the area residents.

area is estimated to be close to $1,000,000 (about $360,000 for nine wells, and the rest for land, water reservoirs, and treatment equipment). In the event that the groundwater becomes polluted to the extent that these wells have to be abandoned, a significant portion of the company's investment would not be salvageable.

5.5.2 Health and Safety Protection Costs

A summary of cost data for the major health and safety protection cost items is presented in Table 2. The estimated total cost is $347,200 which is probably somewhat lower than the actual cost incurred. A number of items for which costs were not available or could not be meaningfully estimated have not been included in this table. These items include: (1) costs associated with the purchase and transportation of bottled and other types of potable water used by a number of residents during the emergency; (2) costs for the water tankers supplied by the National Guard and the Ocean County Civil Defense and Disaster Control; and (3) cost for constructing an activated carbon pilot filter and evaluating its effectiveness for removing organics from the well water. The costs shown in Table 2 are those incurred during the initial probe of the groundwater contamination and do not include ongoing costs for water quality monitoring (by State and Toms River Water Company) and some probable future costs in the event that additional private wells and/or Toms River Water Company's production wells become contaminated. The capital cost for a full-scale activated carbon adsorption system for use by Toms River Water Company has been estimated by the company at about $500,000 (the treatment system currently used consists of chlorination, pH adjustment using lime, and addition of a Calgon Fe-sequestering chemical). Furthermore, property owners in Pleasant Plains whose wells were condemned and were forced to connect to the Toms River Water Company supply are now faced with an average water bill of close to $75.00 per year per service connection, which is subject to periodic rate increases. The water bill would be significantly higher for houses with swimming pools and/or with large lawns or land areas devoted to gardening and vegetable and fruit production for private consumption. (The current cost to an average homeowner for use of a private well is about $45 per year).

TABLE 2. SUMMARY OF HEALTH AND SAFETY PROTECTION COSTS

Item	Estimated Cost, $	Reference or Source of Data for Estimates
Extension of Toms River Water Company's Service to Pleasant Plains		Mr. Ed Hughmanic, Toms River Water Company
Water mains	142,600	
Service lines	15,000	
Fire hydrants	5,000	
Resurfacing of roads	71,700	
Hook-up Cost for Connection to the Toms River Water Company Supply Line (Estimated at $100 Per Connection for 148 Connections)	14,800	Estimated
Twenty New Wells Drilled to the Deeper Kirkwood Aquifer, Estimated at $2,300 Per Well	46,000	Mr. William Endreson, Well Driller
Purchase of Bottled Water, $1000 Per Month for About Four Months (at North Dover Elementary School)	4,000	Mr. Milton Gelzer, School Board Attorney
Cost to Ocean County Disaster Control for the Cleanup/Repair of Water Tanker Used to Provide Emergency Water to Area Residents	900	Mr. William Hayes, Ocean County Disaster Control Coordinator
Water Sampling and Analysis, and Pollution Survey by the Ocean County Board of Health	20,000	Ocean County Board of Health
Services provided by the Dover Township Board of Health in Connection with Water Sampling, Laboratory Tests, Drafting of Resolutions, Ordinances, etc. (February 1, 1974 to November 25, 1974)	3,800	Mr. Paul F. Scavuzzo, Dover Township Board of Health
Analysis of Water Samples at the State Laboratories. (Estimated for 500 Analyses @ $25 Per Analysis)	12,500	Mr. Howard Wiseman, New Jersey State Department of Environmental Protection
Analysis of Water Samples by Private Laboratories (Estimated for 20 Samples at $30 Per Analysis)	600	Mr. Howard Wiseman, New Jersey State Department of Environmental Protection
Carbon Chloroform Extract Determinations Made by EPA (10 Determinations, Estimated at $100 Per Sample)	1,000	Estimated
Volatile Organics Determination by EPA (Edison Laboratory) Using GC/MS and Extraction/IR Methods	1,000	Dr. Francis T. Brezenski, Laboratory Director, EPA Edison, New Jersey Lab.
Four Observation Wells Drilled Around Dover Township Municipal Landfill	3,800	Mr. A. Toscan, Dover Township Public Works Department
Test Wells Dug by Mr. Endreson (to Assist in Elucidating the Pollution Problem)	1,500	Mr. William Endreson, Well Driller
Two Water Quality Monitoring Wells Drilled by Toms River Water Company	3,000	Mr. Ed Hughmanic, Toms River Water Company
TOTAL	347,200	

5.5.3 Indirect Costs

The estimation and expression of the indirect costs are extremely difficult for incidents such as in Dover Township where damage to a natural resource (groundwater) and public inconvenience are involved. Depending on one's point of view, different individuals may assign a different dollar value to the "damage" associated with the resulting inconveniences and the denial to the public of the use of groundwater as a source of domestic water supply. As discussed in Section 4-1, some area residents who are currently bringing a law suit against UCC are claiming four million dollars in exemplary damages and ten million dollars in punitive damages for the contamination of private wells and the personal inconvenience incurred. Prior to the extension of the public water supply to the area, some residents had to travel long distances to obtain water for drinking, cooking and bathing and during the entire period they had to curtail their ordinary consumption of water. The use of private wells is considered by many area residents as a "God-given" right and they feel they have lost a great privilege by being forced to permanently abandon their wells and hook up to a water company's pipeline. Some area residents find it extremely difficult to adjust to the "funny" taste of the chlorinated water from a public water supply.

Additional items of the indirect costs which should be considered in connection with the Dover Township incident are those associated with: (1) law suits against UCC and Fernicola which resulted in a court order for the removal of the waste drums from the Reich farm and payment of $10,000 by UCC to Mr. and Mrs. Reich; (2) Public Utility Commission hearing in connection with the extension of the services of Toms River Water Company to the affected area; (3) administrative involvements of a number of State, Federal, County and Township agencies; and (4) citizens' participation in related meetings and public inquiries. Many of the individuals interviewed during the field investigation could not provide a reasonable estimate of the cost associated with some of the above-mentioned indirect cost items. Some officials of Dover Township indicated that the time and effort devoted to the incident were part of their regular duties and they would have been paid whether or not they worked on the incident.

Three real estate agencies which conduct considerable business in Pleasant Plains were interviewed during the field investigation to obtain the realtors' views on the possible impact of the incident on property values. Mr. Byron Kotzas (Crossroads Realty) indicated that the Pleasant Plains section represents the least spoiled area in Dover Township and is very important to the developers. According to Mr. Kotzas, there was a definite devaluation of property (estimated by Mr. Kotzas at 20 to 25 percent) in the area as a result of the groundwater contamination incident. According to Mr. Krupnick (Surburban Realtors), immediately subsequent to the public disclosure of groundwater contamination, 3 or 4 property owners who wanted to sell their properties could not do so. In general, one of the first questions asked by most prospective buyers was in connection with the source of water supply; properties which were connected to the city water could be sold readily, while those with private wells were very difficult to sell. According to Mr. Hordosky (Toms River Realty), from the time of the first press release on the incident to the time that the public water supply was extended to the area (a period of about 1 year), individuals who wanted to sell their properties could not do so, and that Mr. Hordosky's advice to them was to wait until the problem was resolved. According to Mr. Hordosky, at the time of the interview (May 1975) apparently things were back to normal.

The impact of groundwater contamination and the new State well drilling regulation on the well drilling business in the area was discussed in the interview with Mr. Endreson, an experienced driller. According to Mr. Endreson there are about 30 well drillers in Ocean County. Some of the local well drillers were not experienced and did not have proper equipment for drilling wells to the deeper Kirkwood aquifer. Accordingly, their business was somewhat slowed when wells were to be drilled to the deeper aquifer to obtain water of acceptable quality. The incident in Dover Township was concurrent with a general slowdown in the economy, and, according to Mr. Endreson, probably only about 20 percent of the decline in the well drilling business in Pleasant Plains was due to the restriction and new regulations on well drilling.

According to Mr. Al Gabriel, Superintendent of Building, Township of Dover, the groundwater contamination had a definite adverse impact on the building industry in the area. On the average about 100 to 150 new homes are built annually in the area. This number dropped to about 50 homes per year during the first year of the incident. Mr. Gabriel attributes about 40 percent of the drop to the incident and the other 60 percent to the general slowdown in the economy. According to Mr. Gabriel, the first question asked by most individuals contacting his office to check on buildings was whether the water to a particular building was supplied by the city or by a private well on the property. Several of those interviewed (including Mr. Gabriel) indicated that as far as they knew, none of the area residents moved out of Pleasant Plains because of the contamination incident. According to Mr. Gabriel, a significant number of the residents in the area are retired individuals who have lived there for an appreciable length of time and only under extremely serious circumstances would they consider leaving.

5.5.4 Comparative Abatement Costs

Table 3 presents a recent compilation of industry-furnished cost data for the disposal of organic wastes in excess of 4,000 metric tons per year (4,410 tons per year) from chemical plants. In general, the cost for the disposal of chemical wastes is dependent on the nature and quantity of the waste, hauling distance to the disposal facility, and rules and regulations concerning waste disposal and pollution abatement. Using the high value in the Table for waste disposal by controlled incineration and/or containment in a suitable chemical landfill ($80.00 per metric ton or $72.50 per ton), the cost which would have been incurred if the 6,000 drums of chemical wastes from UCC were disposed of in an environmentally accepted manner would be close to $150,000 (based on a drum size of 208 liters, or 55 gallons, and an assumed waste density of 1.5 kg/l). This estimated abatement cost is significantly less than the $417,300 estimated for the minimum direct and health and safety protection damages incurred. As discussed in the next section, the unfortunate incident in Dover Township might not have occurred had there been Federal and/or State legislations and regulations on the management of hazardous wastes.

TABLE 3. INDUSTRY-FURNISHED COST DATA FOR THE DISPOSAL OF CHEMICAL WASTES*

(For quantities above 4000 metric tons per year)

Disposal Method	Cost	
	$/metric ton	$/ton
Contractor secured unlined landfill, drummed wastes	49.60	45.00
Contractor incineration, drummed wastes	66.10	60.00
Contractor secured lined landfill, drummed wastes	79.40	72.00
On-site lined landfill, drummed wastes	20.00	18.10
On-site controlled incineration	60.00	54.40

*Source: "Assessment of Industrial Hazardous Waste Practices, Organic Chemicals, Pesticides, and Explosives Industries", Final Report prepared by TRW for EPA Office of Solid Waste Management under Contract No. 68-01-2919 (January 1976).

5.6 Regulations and Enforcement

At the time of the Dover Township incident, the only State regulations on the disposal of hazardous wastes were those covered under New Jersey Administrative Code 7:26-1.1 et seq. These regulations constituted the rules of the State Bureau of Solid Waste Management and governed primarily the certification, operation and maintenance of landfill operations in the State and other methods of solid and liquid waste disposal (e.g., incineration) as may have been approved by the Department of Environmental Protection. Hazardous wastes (defined in the Code as those wastes "which can cause serious injury, disease or property damage") could legally be accepted at all registered sanitary landfills meeting certain design and operational requirements. The specified design requirements, however, were very general and did not include provisions to insure containment of hazardous wastes (e.g., through use of liners). Section 7:2.6(c), which covered the specific operational requirements for "hazardous and/or chemical wastes", defined the responsibilities of waste generator, waste hauler, and waste receiver (landfill operator, chemical incinerator operator, recovery operator, or treatment operator) as follows:

1. "The shipper shall provide minimum labels in accordance with the current Federal regulations for 'Explosives and Other Dangerous Articles'. Where unlisted hazardous wastes in any quantity are to be disposed, the shipper will provide such information as may be required to ensure safe disposal. In these cases, this should include prior arrangement with the disposal area, or treatment or salvage company, in order that they can be alerted in advance to assure safe handling.

2. "The shipper shall issue a bill of lading to accompany each shipment of waste chemicals. This bill of lading shall be used to communicate with those handling these waste chemicals to alert them of their hazards or nuisance potential by including appropriate warning notations, or by use of a stamp showing the material to be a flammable liquid, or

flammable solid, or spontaneously combustible, or dangerous when wet, or oxidizing agent, or organic peroxide, or poison, or acid, or caustic, or nonhazardous, or emitting a noxious odor, and so forth.

3. "The contractor engaged in transporting hazardous chemicals is responsible for operating within existing laws governing the transportation of dangerous articles including Chapter 128, Laws of New Jersey 1950.
4. "The operator of any disposal facility is responsible to operate in compliance with all laws and regulations.
5. "No chemical wastes, liquid or solid, shall be deposited in direct or indirect contact with surface or groundwaters of the State."

Even the above-listed specific operational requirements were very vague, inadequate and unenforceable. For example, although the waste haulers had to be registered with the State, the registration was very simple and almost anybody could qualify as a registered waste hauler. There was no effective system of accountability which would ensure that the waste hauled from a chemical production facility would reach its destination. In fact, when the storage of the drums at the Reich farm first came to light, the area residents and many public officials were surprised to learn that the existing regulations only covered waste storage/disposal at registered sanitary landfills and incineration facilities. Indeed, according to a story in the August 4, 1974, issue of the Asbury Park Press (Exhibit C-10, Appendix C), Mr. Fernicola defended his action of storing waste drums at the Reich farm contending that there were no State regulations covering the dumping of chemical wastes on a private property and that he "did nothing wrong" and "broke no law".

In June 1974 the State Department of Environmental Protection adopted new regulations for landfill disposal of hazardous wastes. These regulations are specific and are significantly more stringent than those previously in effect. According to these regulations, no land disposal facility can accept hazardous wastes unless it has installed a system for the collection and treatment of the leachates. When the regulations were first promulgated, the deadline for the installation of leachate collection/treatment facility was set for March 15, 1975. Since most landfills stated that they could not comply with this regulation within the specified time frame, the deadline was later extended to September 15, 1975. The extension of the deadline was also intended to give the State additional time to study solid waste management problems, and to discuss their solution with private industry, landfill operators and collectors and haulers. In September 1975 the State Department of Environmental Protection issued a second emergency rule delaying until further notice the regulation requiring all disposal facilities which take any chemical or hazardous wastes to have a collection and treatment system for leachate. The primary reason for the delay, the State said, is lack of facilities in New Jersey which can treat and dispose of all chemical and hazardous wastes in a manner which complies with this regulation. Most recently (Sept. 1975), the State proposed regulations prohibiting disposal of about 100 highly toxic, corrosive, carcinogenic or explosive substances in landfills without special permission from the State. The list will be revised from time to time as more information on chemical wastes becomes available. Under the proposal, anyone who wishes to dispose of designated wastes in a landfill must show the State that alternative disposal methods are unavailable and that potential impacts on the environment will be minimized.

One important feature of the new regulations is that it holds the waste generator responsible for assuring that the selected waste hauler is registered with the Bureau of Solid Waste Management and that the shipment is consigned to a solid waste facility registered with and authorized by the Bureau for the disposal of specific types of hazardous waste. Both the waste generators and the registered operators of the solid waste facilities are also required to submit to the State annual reports on the quantity and nature of the generated/disposed of hazardous wastes.

To date the chemical wastes from many industrial facilities in the State have been disposed of in sanitary landfills which are not designed to contain hazardous chemicals. In addition to definite possibilities for the contamination of air, water, and land resources, there have been some documented (and probably numerous undocumented) cases of direct damage to personnel and property at various landfills. A recent example of such incidents is an explosion at Kin-Buc Landfill (Edison Township, N.J.) in which a bulldozer operator was killed and the bulldozer (valued at $91,000) was destroyed. Kin-Buc Landfill receives a portion of the industrial wastes generated at the UCC Bound Brook facility and has been in operation for approximately 12 years. A recently published EPA damage report, which provides details on the above-mentioned incident and other aspects of the operation at the site, is reproduced in Appendix D.

Messrs. Bernhardt V. Lind and Lino F. Pereira of the New Jersey State Bureau of Solid Waste Management were interviewed in Trenton on May 14, 1975 in connection with the present study. Both men indicated that the State was doing its best to develop and implement an effective hazardous waste management program. The State of New Jersey is a major chemical producing State and as such generates significant quantities of hazardous wastes which have to be handled and disposed of in a manner compatible with protection of the environment and the health and safety of the residents of the State. The new regulations are steps in the right direction for developing a State-wide enforceable program for the control of hazardous wastes.

5.7 Social and Political Impacts

Based on the data collected in the field interviews, many of the affected residents in Pleasant Plains remain dissatisfied with having been forced to abandon their private wells and connect to the Toms River Water Company Supply line. In general, the residents feel that their wells provided them with a relatively abundant supply of water at low cost whereas the public water supply is more expensive. Hence, they have to curtail their water consumption, especially during the summer months when a large volume of water is needed for watering lawns, filling swimming pools, and backyard production of fruits and vegetables.

To provide a forum for airing grievances and to represent the interests of the property owners in matters pertaining to water quality investigations, well condemnation, and extension of the public water supply to the area, a citizen group known as "The Pleasant Plains Residents for Pure Water Association" has been formed by some area residents. The Association strongly opposes the well closing ordinance and has considered bringing a lawsuit against the Dover Township Board of Health on this matter. Some of the comments received from the individuals interviewed are presented in Appendix E. These comments may or may not represent the opinion of the majority of the area residents.

One major criticism often voiced by the officials of Dover Township and Ocean County relates to a lack of preparedness heretofore on the part of State and Federal agencies to respond quickly to incidents such as the groundwater contamination in Pleasant Plains. According to the local officials, when the groundwater contamination first surfaced, the State was very slow in responding to the needs of the local community and in providing technical support and analytical services. According to the State, at the time of the incident, the State lacked adequate manpower, laboratory facilities, and funds to respond to the emergency. When the U.S. Environmental Protection Agency was contacted to investigate the problem, EPA indicated that it "does not have the responsibility for finding the cause of the contamination since it has only affected private wells, not the public water supply".* (Note: EPA provided analytical support to ascertain the presence of organic contaminants in the water supply from certain suspected wells.) Faced by apparent inaction on the part of the State and Federal agencies, Mrs. Katherine Nelson (an area resident whose well had been most adversely affected) wrote to her Senator (Senator Williams) requesting appropriate action.

During the field interviews in New Jersey, the political implications of the Dover Township incident were explored in discussions with the ex-Mayor of the Township, Mrs. Ethel Zaun (Democrat), and Mr. Manuel Hirshblond, the Township Administrator. Both individuals discounted any major political "fall-out" from the incident. Mrs. Zaun was the Township Mayor during the incident and was unseated in 1974 by her Republican opponent. She had supported the Township Board of Health efforts in getting the wastes removed from the Reich farm, providing emergency water supply for the area residents, and extending public water service to the area. According to Mrs. Zaun, the Dover Township incident was no more of an important campaign issue than other topics such as gasoline shortage, employment, and the local economy.

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* Comments attributed to Mr. Everett MacLeman, Chief of the U.S. EPA Regional Water Supply Branch, in a newspaper story ("U.S. Can't Probe Problem: Wells' Pollution is Still Mystery") which appeared in the January 4, 1975, issue of the Asbury Park Press.

APPENDICES

APPENDIX A

WASTE CHARACTERISTICS, WATER QUALITY AND MISCELLANEOUS SUPPORT DATA

- List of Individuals Interviewed and Specific Topics Discussed (Table A-1)
- General Description of UCC Chemical Wastes found on the Reich Farm (Tables A-2 and A-3)
- Water Quality Data (Tables A-4 through A-7, Figure A-1)
- NAS Hazard Evaluation Criteria used for Hazard Rating of Selected Individual Chemicals Identified in UCC Wastes (including Tables A-8 and A-9).

TABLE A-1. LIST OF INDIVIDUALS INTERVIEWED AND SPECIFIC TOPICS DISCUSSED

Interview Date	Person Interviewed	Title/Affiliation	Business Address and Telephone Number	Discussion Topics/Information Obtained
5-13-75	Mr. Howard Wiseman	Principal Environmental Engineer Water Pollution Control Operation and Enforcement State of New Jersey Department of Environmental Protection	1474 Prospect Street P. O. Box 2809 Trenton, N.J. 08625 (609) 292-7418	Water quality data on contaminated wells; ongoing water quality surveillance program; historical background on the contamination case; key individuals and agencies to be contacted for data acquisition.
	Mr. Frank Markewicz	Supervising Geologist Office of Special Services Geological Services Division of Water Resources State of New Jersey Department of Environmental Protection	Same as above	Hydrogeology of the affected area; causes and extent of groundwater contamination; aquifer purging possibilities, well drilling and associated costs; additional key individuals and agencies to be contacted for data acquisition.
5-14-75	Mr. Bernhardt V. Lind	Bureau of Solid Waste Management New Jersey State Department of Environmental Protection	Labor and Industry Building Trenton, New Jersey 08625 (609) 292-7645	New Jersey regulations governing landfill disposal and hazardous waste management; current and planned State programs on monitoring hazardous waste disposal practices by the chemical industry and by "off-site" disposal contractors.
	Mr. Lino F. Pereira	Bureau of Solid Waste Management New Jersey State Department of Environmental Protection	Same as above	Same as above
	Mr. Robert DeSando	Staff Reporter Asbury Park Press	64 Washington Street Toms River, New Jersey (201) 349-7000	Newspaper coverage of the Dover Township incident and related developments.
	Mr. Byron Kotzas	Crossroads Realty	Main Street and Route 37 Toms River, New Jersey 08753 (201) 244-4900	Impact of incident on the real estate prices in the area; information on people moving out or not moving in as a result of the publicity surrounding the incident.
	Mr. Don O'Rourke	Resident in the Pleasant Plains Section Also Assistant Director Bureau of Public Relations County of Ocean	Court House Toms River, New Jersey (201) 244-2121	Public reactions to and the extent of personal health and economic hardship attributed to the incident.
5-15-75	Mr. Lawrence Stanley	Deputy Attorney General State of New Jersey	36 West State Street Trenton, New Jersey (609) 292-1566	Legal considerations surrounding the case and the extent of State involvements in associated litigations.
	Mr. William P. Bobsein	Manager Environmental Technology Department Toms River Chemical Corporation	Box No. 71 Toms River, New Jersey 08753 (201) 349-5200	Current and planned waste management and pollution control programs at Toms River Chemical Company

TABLE A-1. LIST OF INDIVIDUALS INTERVIEWED AND SPECIFIC TOPICS DISCUSSED (CONTINUED)

Interview Date	Person Interviewed	Title/Affiliation	Business Address and Telephone Number	Discussion Topics/Information Obtained
5-16-75	Mr. Charles Kauffman	Public Health Coordinator Ocean County Health Dept.	P. O. Box 2191 Toms River, New Jersey 08753 (201) 244-2121 X-289	Chronology of the incident and the discovery and documentation of the groundwater contamination; health implications of the incident; recommendations for avoiding similar incidents in the future; copies of documents related to the case.
	Mrs. Ruth Matthews	Ex-President Dover Township Board of Health	Box 238-B Silverton Rd. Toms River, New Jersey 08753 (201) 349-0682 (home)	Same as above plus a listing of additional key individuals to be contacted.
	Mr. William Endreson	William Endreson and Sons (Well Drillers)	P.O. Box 122 Seaside Park, New Jersey (201) 244-6699	Estimated replacement value of the condemned wells and their associated appurtenances; current cost for drilling wells to the uncontaminated aquifer (Kirkwood aquifer); economic impact of the incidents on the well-drilling business in the area.
	Mr. Al Gabriel	Superintendent of Building	54 Washington Street Toms River, New Jersey (201) 341-1000 Ext. 35	Short-term and long-term economic effect of the incident on the local housing industry; role of the Township Government in locating and removing wastes from the Reich Farm and other illegal disposal sites.
5-19-75	Mr. Manuel Hirshblonde	Township Administrator	Town Hall Washington Street Toms River, New Jersey (201) 341-1000 Ext. 57	Political implication of the incident; voting pattern in the recent mayoral election in Dover Township; overview of the problem.
	Mr. Richard Clements	Chief Dover Township Police Department	Toms River, New Jersey	Initial public reactions to the incident; role of police in securing and protecting the Reich Farm when waste drums were first discovered.
	Mr. William Hayes (Telephone inquiry)	Ocean County Disaster Control Coordinator Ocean County Civil Defense and Disaster Control	(201) 244-2121 Ext. 200	Cost and problems associated with bringing emergency water supply to the area.
	Mr. John Hordosky (Telephone inquiry)	Toms River Realty	393 Lakehurst Road Toms River, New Jersey (201) 341-3100	Impact of incidents on the real estate prices in the area; information on people moving out or not moving in as a result of the publicity surrounding the incident.
	Mr. A. Toscan	Public Works Department (Assistant to Mr. Jack Thomas, Superintendent of Public Works)	Church and Bay Avenue Toms River, New Jersey (201) 349-1000	Operations of the Dover Township landfill; types of wastes accepted; regulations and enforcement relating to hazardous wastes; leachate monitoring program.
	Mr. Ed Hughmanic	Vice President Toms River Water Company	15 Adfre Avenue Toms River, New Jersey (201) 349-0227	Cost of extending water supply service to the Pleasant Plains section; treatment methods and water quality monitoring programs; preliminary plans for installation of an activated carbon system for use in case of an emergency.

TABLE A-1. LIST OF INDIVIDUALS INTERVIEWED AND SPECIFIC TOPICS DISCUSSED (CONTINUED)

Interview Date	Person Interviewed	Title/Affiliation	Business Address and Telephone Number	Discussion Topics/Information Obtained
5-20-75	Mr. Milton H. Gelzer	Hiering, Grassu, Gelzer and Kelaher (Law Offices) (Attorney for Mr. and Mrs. Reich, and for the North Dover Elementary School)	Court House Square Toms River, New Jersey 08753 (201) 349-1212	Cost to the school district for bringing in emergency bottled water; background on the initial court cases against Union Carbide Corporation and Fernicola brought about by Mr. and Mrs. Reich, and the Dover Township Board of Health
	Mr. Joseph L. Foster, Esq.	First Assistant Township Attorney Law Department Township of Dover	P.O. Box 728 Toms River, New Jersey 08753 (201) 341-1000	Public Utility Commission hearings which resulted in extention of the Toms River Water Company service to the Pleasant Plains Section; copies of court documents and affidavits involving original litigations against Union Carbide Corp. and Fernicola.
	Mr. A. Morton Cooper	Chairman Township of Dover Environmental Commission	54 Washington Street Toms River, New Jersey 08753 (201) 341-1000	Functions and responsibilities of the Environmental Commission and its recommendations for avoiding contamination incidents in the future.
	Mr. Thomas M. Neil	Code Enforcement Officer Township of Dover	P.O. Box 146 Toms River, New Jersey 08753 (201) 341-1000	Problems associated with investigating reported violations of the environmental codes. General views on possible sources of groundwater contamination in Dover Township.
	Mr. John Fitzgerald	President The Pleasant Plains Residents for Pure Water Association (Pleasant Plains resident)	Sunset Avenue Pleasant Plains Toms River, New Jersey	Views of the Pleasant Plains residents on the groundwater contamination case; economic hardships endured as a result of the condemnation of the contaminated wells; reported cases of ill health possibly arising from the use of contaminated water.
	Mr. Ray Mckelvey	Resident Pleasant Plains	Sunset Avenue Pleasant Plains Toms River, New Jersey (201) 349-2253	Same as above
5-21-75	Mr. Rippey	Extention Service Agricultural Center Rutgers - The State University	Toms River, New Jersey (201) 349-1245	Groundwater contamination and its possible impact on the local farming and agricultural activities.
	Mr. Alfred Carlson	Ocean County Agricultural Agent	Same as above	Same as above
	Dr. Jassie, M.D. (Telephone inquiry)	Urologist Private Physician (Substituting for Dr. Zuravin)	(201) 349-0088	Actual adverse health effects (complaints) which may be attributed to the use of contaminated groundwater.
	Mr. Sidney Krupnick	President Surburban Agency, Inc., Realtors	130 First Street Lakewood, New Jersey 08701 (201) 363-6000	Impact of the incident on the real estate prices of Pleasant Plains; information on people moving out or not moving in as a result of the publicity surrounding the case.

TABLE A-1. LIST OF INDIVIDUALS INTERVIEWED AND SPECIFIC TOPICS DISCUSSED (CONTINUED)

Interview Date	Person Interviewed	Title/Affiliation	Business Address and Telephone Number	Discussion Topics/Information Obtained
5-21-75 (Cont'd)	Mrs. Katherine Nelson	Resident Pleasant Plains Section	1532 Lakewood Road Toms River, New Jersey (201) 349-5112	Case history of contamination of Mrs. Nelson's well, economic hardship sustained as a result of the well contamination.
	Dr. Sawyer, M.D. (Telephone Inquiry)	Private Physician	(201) 349-0275	Actual adverse health effects (complaints) which may be attributed to the use of contaminated groundwater.
	Mr. Ellery Fox	Attorney at Law	1108 Hooper Avenue Toms River, New Jersey 08753 (201) 244-6827	The suit being brought about by four home owners and the owner of one store in the Pleasant Plains section against Union Carbide Corporation.
	Mr. & Mrs. Samuel Reich	Owner of Reich Chicken Farm	1579 Lakewood Road Toms River, New Jersey (201) 349-4264	Chronology of the events leading to storage and subsequent discovery of waste drums on Reich's property, legal actions which resulted in the court order for the removal of the waste drums.
5-22-75	Mrs. Ethel Zaun	Former Mayor of Dover Township	1584 Whitty Road (201) 341-2023	Political implications of the incident and its possible role in the loss of majoral elections by Mrs. Zaun.
	Mr. J. S. Baker	Manager Safety and Environmental Protection Union Carbide Corporation Chemicals and Plastics	River Road Bound Brook, New Jersey 08805 (201) 356-8000	Chronology of events leading to the discovery of illegal storage of chemical wastes from Union Carbide plant in the Reich Farm; nature and quantity of the uncovered wastes; prior and current methods for the ultimate disposal of chemical wastes from the Bound Brook facility; Union Carbide's view of the overall problem.
	Mr. S. Joseph Fortunato	Attorney at Law Pitney, Hardin and Kipp	310 South Street Morristown, New Jersey 07960 (201) 267-2010	Same as above

TABLE A-2. GENERAL DESCRIPTION OF UCC CHEMICAL WASTES FOUND ON THE REICH FARM [*]

(Listing of materials originally designated for shipment to Rollins-Purle waste disposal facility in Logan Township, New Jersey) [†]

UCC Code	Label Required [§]	General Description
001		Phenolic resin from "B" batches
010	R.L.	Waste solvents from Quality Control Labs
101	C.L.	Miscellaneous drums of phenol and butyl phenol
102	C.L.	Miscellaneous drums of solid phenol and butyl
103		Tar pitch
104		Butyl phenol pitch
105		Butyl phenol pitch
201		Waste epoxy hardeners
202	R.L.	Waste epoxy resin (reactive with other resins)
204		Waste epoxy resin (reactive with other resins)
205		Fines from substituted phenolic resins
206		Filter cartridges with resins
208		Substandard resins - phenolic
209	R.L.	Lab samples of resins
211	R.L.	Methyl isobutyl ketone from production of epoxy
213	C.L. & P.L.	Epichlorohydrin, ethanol, and water mixtures
216	C.L. & P.L.	Epichlorohydrin recycle from epoxy resins
300	R.L.	Butanol and toluene mixture
302		Waste polystyrene
303	C.L. & P.L.	Bisphenol, epichlorohydrin, caustic, butanol, toluene mix.
304		Substandard phenoxy solutions
305	R.L.	Phenoxy polymer and MEK mixtures
307		Dichlorobenzene and styrene residue mixtures
308	R.L.	Lab waste solvents
309		Styrene and fatty acids mixtures
310		Flash pot bottoms (solid) styrene
311		Styrene, acrylonitrile, and solvents mixtures
312		Flash pot bottoms (solid) C-11
313		Styrene, acrylonitrile, MEK, cloral and toluene
314		Styrene, MEK, toluene, and trichloroethylene mixtures
315		Color room; cleaning of pots, degreaser and mixing bowls - solid
316		Alumina and styrene mixtures
401	Y.L.	Partially filled bottles, test tubes, etc.
403		Pilot work on polystyrene
405		High boiling out of epoxy resin purification molecular still
408		Waste solids
409	Y.L.	Miscellaneous solid resin wastes
502		Blends of resin and oil
803	Y.L. & P.L.	Filters from phenol plant

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[*] Source: A UCC letter dated February 21, 1972, from Mr. Wm. C. Lund, Coordinator Environmental Protection - Engineering, UCC, Chemicals and Plastics, Bound Brook, New Jersey, to Mr. Arthur W. Price, Chief, Bureau of Solid Waste Management, New Jersey State Department of Environmental Protection

[†] As discussed in the text, these wastes were instead returned to the Bound Brook plant for temporary storage and subsequent disposal in an approved manner.

[§] R.L. - Red Label, P.L. - Poison Label; C.L. - Corrosive Label, Y.L. - Yellow Label.

TABLE A-3. GENERAL DESCRIPTION OF UCC CHEMICAL WASTES FOUND ON THE REICH FARM *

(Listing of materials selected for shipment to the UCC plant in Marietta, Ohio, for incineration)

UCC Code	Label Required †	General Description
106	R.L. & C.L.	Miscellaneous liquid (some phenol)
200	R.L.	Phenolic resin scrap with solvents (methanol)
203	R.L.	Waste acrylic resins with solvents
210	R.L.	Acetone still wash with phenolic resin
212	R.L.	Dirty xylene from still wash
214	R.L.	Toluene and ethanol still wash mixture
215	R.L.	Toluene still wash
217	R.L.	Toluene and phenolic resin mixture
301	R.L.	Butanol, toluene, and phenoxy polymer mixtures
306	R.L.	Solvent washes of process equipment
400	R.L.	Combination of solvents
402	R.L.	MEK, toluene, ethanol, and acetone mixtures
404		Waste resin, solvent, and water mixtures
406	R.L.	Resin, toluene, isopropanol, sodium chloride
407	P.L.	Polysulfone resin, methanol, MCB, and toluene mixtures
410	R.L. & P.L.	Resin and methanol mixtures
500	R.L.	Printer wash solvent
501	R.L.	Mineral spirits, solvent, and plastizol mixtures
600		Vinyl operations - vinylite production waste
900		Waste oil, grease and lubricants

* Source: A UCC letter dated February 21, 1972, from Mr. Wm. C. Lund, Coordinator Environmental Protection - Engineering, UCC, Chemicals and Plastics, Bound Brook, New Jersey, to Mr. Arthur W. Price, Chief, Bureau of Solid Waste Management, New Jersey State Department of Environmental Protection.

† R.L. - Red Label; P.L. - Poison Label; C.L. - Corrosive Label.

TABLE A-4. SAMPLING POINTS AND RESULTS OF TOTAL ORGANICS (ETHER EXTRACTABLES) DETERMINATIONS*, MARCH 14-JUNE 17, 1974, SAMPLING PROGRAM

Sampling Locations		Total Organics (Ether Extractables), PPM
Lakewood Road	Monroe Avenue to Church Road	Negative to 18 ppm
Church Road	Lakewood Road to Old Freehold Road	Negative to 9.5
Sunset	Lakewood Road to Whitesville Road	1.1 to 5.2
Clayton Avenue	Lakewood Road to Whitesville Road	Negative to 21.3
Caroline	Clayton to Sunset	4.1 to 4.2
Monroe	Lakewood Road to Sunset	2.8 to 6.6
Lena Avenue		Negative

*The organics were removed from water by adsorption on activated carbon; the spent carbon was then dried and eluted with ether to recover and determine the quantity of the adsorbed organics.

TABLE A-5. SAMPLING DATES, LOCATIONS, AND CCE* TEST RESULTS

Date	Location	CCE*, PPM
6/19-21/74	Pl. Plains Fire Department	0.4
6/19-21/74	Toms River Water Co. Well # 20	0.1
7/9-11/74	Nelson Residence	1.2
7/16-18/74	Fir Aid Bldg., Clayton Avenue	0.4
7/16-18/74	Elementary School, Church Road	0.1
7/18-20/74	Toms River Water Company #26	0.2

* CCE = Carbon Chloroform extract

TABLE A-6. SAMPLING LOCATIONS AND GC/MS ANALYSIS FOR VOLATILE ORGANICS (DATE SAMPLED: JULY 11, 1974)

Location	Results
Toms River Water Company - Well # 22	0.1 ppb Volatile Organics
Ocean County Agricultural Buidling	" " " "
North Dover School	" " " "
Mrs. Nelson - 1532 Lakewood Road	12 ppb Toluene; 30 ppb Styrene

TABLE A-7. ORGANIC ANALYSIS OF WATER SAMPLES; JULY 31-NOVEMBER 9, 1974 *

Sampling Locations †		Depth of Well (Sample Taken), Meters (Ft.)	Total Organics by CCl_4/IR Absorption Method, PPM									Oil and Grease		
Address/Name	Map Point		Date: 7/31	8/8	8/20	8/27 §	8/27 §	10/12	11/2	11/4	11/9	Date Sampled	PPM	% HC
1426 Lakewood Rd.	1	-				0.21	0.74					8/27	4.4	25
1532 Lakewood Rd.	2			1.9								8/28	4.4	25
1626 Lakewood Rd.	3										0.06			
1641 Lakewood Rd.	4	-				0.25	0.37	0.25				8/27	5.0	80
1680 Lakewood Rd.	5	-				0.62	56	0.62				8/27	8.5	84
1708 Lakewood Rd.	6										0.03			
1725 Lakewood Rd.	7	-				0.37	0.37	0.52				8/27	4.8	81
1752 Lakewood Rd.	8	9.1 (30)				.25	0.25				0.11	8/28	8.9	74
1999 Lakewood Rd.	9			0										
Midway Poultry Farm	10	15.9 (52)	32	0.5	0.10									
Hecht Bros	11	-		0.5										
Governors Road Lakewood Twp.	N/A			0.7										
North Dover Elementary School	17	22.9 (75)	68	1.2	0.10	0.27	0.50					8/8 8/27	8.0 2.3	58 65
St. Andrews Church	18	-	64	1.0	0.10	0.49	0.40					8/8	5.5 8.1	60 23
265A Old Freehold	19					0.39	0.50					8/27	10.7	15
265B Old Freehold	20										0.03			
265C Old Freehold	21										0.09			
268 Old Freehold	22	-	2.4											
1472 Old Freehold	-										0.14			

* Source: State of New Jersey, Department of Environmental Protection

† See map in Figure A-1 for location of sample points

§ Duplicate samples were tested; the first set of numbers are results of New Jersey State Health Department; the second set of dates are results from EPA laboratories.

TABLE A-7 (CONTINUED). ORGANIC ANALYSIS OF WATER SAMPLES; JULY 31-NOVEMBER 9, 1974 *

Sampling Locations *		Depth of Well (Sample Taken), Meters (Ft.)	Total Organics by CCl_4/IR Absorption Method, PPM									Oil and Grease		
Address/Name	Map Point		Date: 7/31	8/8	8/20	8/27 §	8/27 §	10/12	11/2	11/4	11/9	Date Sampled	PPM	% HC
Jewish Center	24	22.9 (75)				0.22	0.43					8/27	3.0	33
1112 Silverton	31	25.3 (83)				0.27	0.65					8/27	4.8	89
1247 Silverton	33					0.38	0.98					8/27	3.1	6.5
152A Whitesville	40	-		0.4										
753 Whitesville	41	9.1 (30)	3.4											
1236 Whitesville	42	21.3 (70)	34	0.5	0.10									
1272 Whitesville	43	-				0.31	0.82					8/27	2.0	40
Riverwood Pk.	44	-	3.8	0.5	0.30									
Camp Albacando	44	15.2 (50)	2.4											
Berkeley Water Co. well 1A	N/A	20.4 (67)				1.04	0.59					8/27 9/5	5.3 3.7	75 7.8
Cedar Glen Homes Water Co. well 1A	45	19.8 (65)	2.6											
Cedar Glen Homes Water Co. well 3	46	19.8 (65)	2.4											
Toms River Water Co. well 20	47	29.3 (96)	2.6					1.23						
Toms River Water Co. well 22	47	38.1 (125)						0.92			0.04			
Toms River Water Co. well 24	49	38.1 (125)						1.24		0.08				
Toms River Water Co. well 26	50	38.1 (125)	2.7							0.11				
1818 New Hamp	51	25.9 (85)	2.4											
2454 New Hamp	52	-	3.0											
White But Road 245	53					0.32	0.60					8/27	13.5	30
Route 70 Buckwald Inn	N/A				0.3									

TABLE A-7 (CONTINUED). ORGANIC ANALYSIS OF WATER SAMPLES; JULY 31-NOVEMBER 9, 1974 *

Sampling Locations		Depth of Well (Sample Taken), Meters (Ft.)	Total Organics by CCl_4/IR Absorption Method, PPM									Oil and Grease		
Address/Name	Map Point		Date: 7/31	8/6	8/20	8/27 §	8/27 §	10/12	11/12	11/4	11/9	Date Sampled	PPM	% HC
GS Parkway State Police	54			0.6										
Toll Plaza	[illegible]					0.53	1.20					8/27	1.6	75
2474 Vermont Ave.		22.3 (73)	6.0	0.5	0.3									
1642 Todd Road	58	-	2.4											
1604 Bay	59	-	2.1											
1856 Bay	60	-	13	0.6	0.10									
Oak Parkway Armory,	N/A	15.2 (50)	2.4											
Hill Top Shell	N/A	-	36	0.2	0.5									
1404 Wallach Drive	[illegible]	19.8 (65)						1.02	0.10					
1406 Wallach Drive	62								Neg.					
1407 Wallach Drive	63								0.13					
1408 Wallach Drive	64								0.10					
1409 Wallach Drive	65								0.09					
862 Whitty Drive	66					0.36	0.65						3.3	79
YMCA	67	N/A				0.34							3.6	67
13 Dugans Lane	68								0.07					
15 Dugans Lane	69								0.09					
31 Dugans Lane	70								0.13					
48 Dugans Lane	71					.41	1.06	0.82	0.06				2.1	79
32 Stevens Road	73					0.36	0.59						3.6	55
150 Stevens Road	75					0.39	0.66						5.0	74
Toms River Chem. Well 100A	76	32.0 (105)									Neg			
Well 400	77	29.9 (98)									.03			
Well 502	78	16.3 (83)									.08			
Well 503	79	3.6 (110)									.14			
Well 504	80	28.4 (93)									Neg			

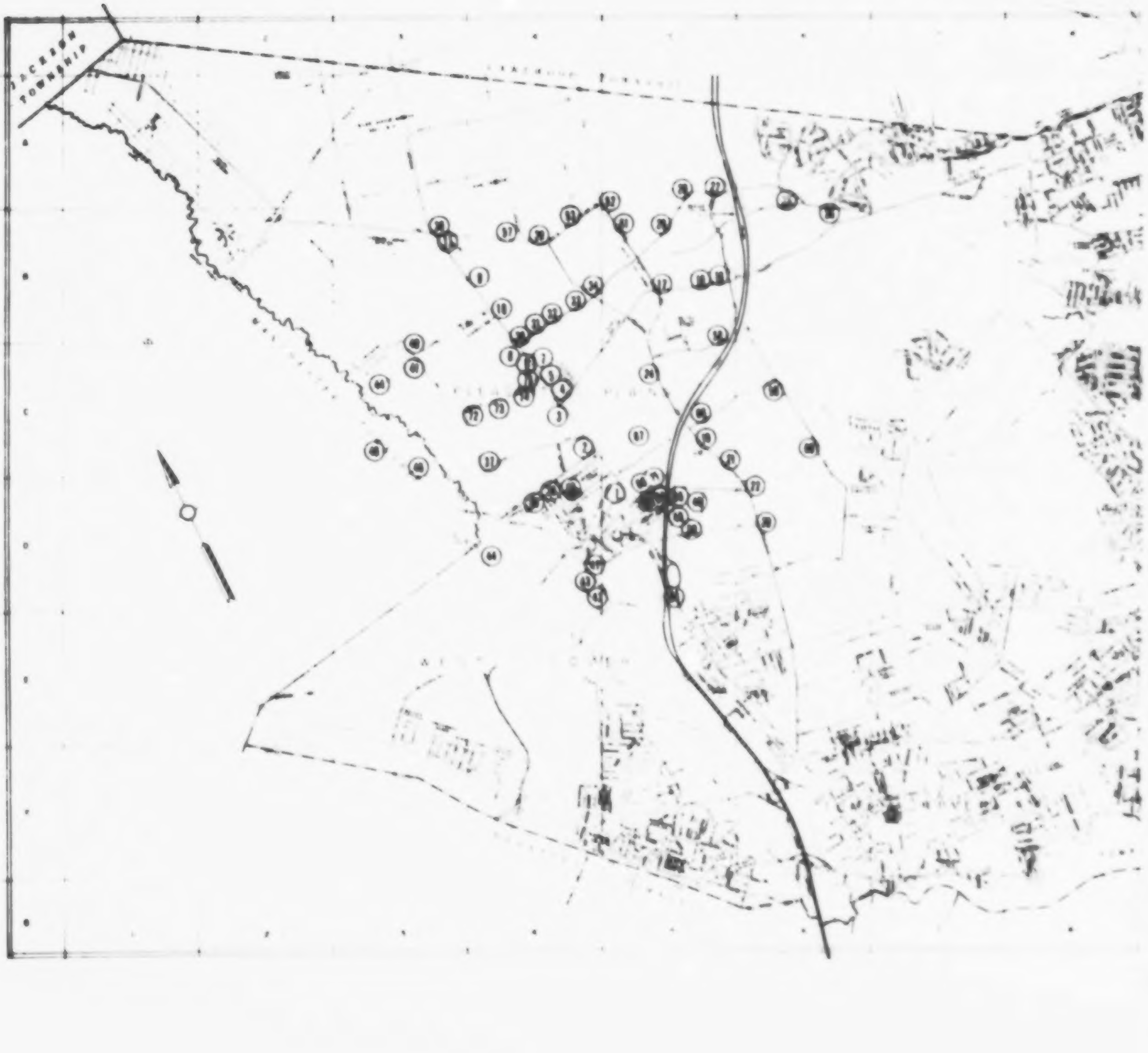

JACKSON TOWNSHIP

Figure A-1 Location of Wells Sampled for Organic Analysis (See Table A-7 for test results).

NAS HAZARD EVALUATION CRITERIA USED FOR HAZARD RATING OF SELECTED INDIVIDUAL CHEMICALS IDENTIFIED IN UCC WASTES

At the present time there is no universally accepted rating system for quantitative assessment and comparison of hazardous characteristics of chemicals. Table A-8 presents a hazard evaluation criteria developed by the National Academy of Sciences (NAS) for use by the U.S. Coast Guard for the evaluation of hazards of bulk water transportation of industrial chemicals. Depending on its properties and for each category of hazard considered, a chemical can be rated on a numerical hazard scale ranging from Grade 0 (insignificant hazard) to Grade 4 (extremely hazardous). The basis and the quantitative range from the rating system are included in Table A-8 and are, in general, self-explanatory. From the standpoint of practical application, however, it is necessary to point out some of the limitations of the data base for hazard classification in the "poison", "human toxicity" and "aquatic toxicity" hazard categories.

The poison hazard rating is based primarily on the likelihood for producing toxic effects through inhalation. In this hazard category, a Grade 4 rating indicates severe toxicity and in general, corresponds to a threshold limit below 10 ppm. A Grade 2 rating signifies some hazard, typically corresponding to threshold limits of 100 to 500 ppm. The human and aquatic toxicity ratings are based on published toxicity data (oral LD_{50} and TL_m) for laboratory animals and fish. LD_{50} (Lethal Dose 50) is the orally administered dose of a substance which will kill 50% of a group of test animals to which it has been administered, within a specified time period. The dose is usually expressed in mg or g of substance per kg of animal body weight. TL_m (median threshold limit) is that concentration of a substance in water which will kill 50% of the exposed test organisms (usually fish) within a specified period of time (usually 96 hours). Both TL_m and LD_{50} represent acute toxicity and not the possible long term (chronic) toxic effects. Furthermore, neither of the two indices give any indication of possible non-lethal ill effects which may result at lower dosages or concentrations. Most importantly, TL_m and LD_{50} are based on bioassay tests on laboratory animals and can only be used as practical guides for predicting the toxic effects of chemicals on humans. In setting water quality goals and recommending water quality standards, regulatory agencies usually multiply the TL_m values by a somewhat arbitrarily selected "application factor" to arrive at a recommended "safe" limit. Depending on the use of the water, application factors commonly used range in numerical value from 1/1000 to 1/10.

Using the hazard evaluation criteria shown in Table A-8, with appropriate modifications to reflect other properties not shown in the table, the NAS study rated the hazard properties of 337 industrial chemicals. Then 337 industrial chemicals include 15 chemicals which, on the basis of the data in Tables A-2 and A-3, are identified as chemically recognizable individual compounds in the UCC Wastes. The ratings for these 15 chemicals are shown in Table A-9 and are discussed in Section 5.3.

TABLE A-8. HAZARD EVALUATION CRITERIA*

GRADE	I	II	III	IV	V	VI	VII	VIII	IX	X
	FIRE	HEALTH			WATER POLLUTION			REACTIVITY		
		Vapor Irritant	Liquid or Solid Irritant	Poisons	Human Toxicity	Aquatic Toxicity	Aesthetic Effect	Other Chemicals	Water	Self-reaction
0	No hazard	No effect	No effect	No effect	Nontoxic, LL_{50} 15 g/kg	TLm above 10,000 ppm	No significant pollution, gases and odorless liquids	Inactive, may be attacked by Grade 4	No reaction	No reaction
1	Closed cup, flash point above 140°F	Slight effect	Causes skin smarting	Slightly toxic	Practically non-toxic, LL_{50} 5-15 g/kg	TLm 1,000 to 10,000 ppm	Mild-odored light oils and soluble chemicals	React only with Grade 4	Mild reaction, unlikely to be hazardous	Mild self-reaction under some conditions
2	Flash point 100 to 140°F	Moderate irritation, temporary effect	First-degree burns, short exposure	Intermediate toxicity	Slightly toxic, LL_{50} 0.5 to 5 g/kg	TLm 100 to 1,000 ppm	Mild-odored, colorless, water-insoluble oils, B.P. 150-450°F	React with Grades 3 and 4	Moderate reaction	Will undergo self-reaction if contaminated, do not require stabilizer
3	Flash point below 100°F B.P. above 100°F	Irritating, cannot be tolerated	Second-degree burns, few minutes exposure	Moderately toxic	Moderately toxic, LL_{50} 50-500 mg/kg	TLm 1 to 100 ppm	Light-colored high-boiling oils, odorous water-soluble compounds	React with each other and with those of Grades 2 and 4	More vigorous reaction, may be hazardous	Vigorous self-reaction, requires stabilizer
4	Flash point below 100°F B.P. below 100°F	Severe effect, may do permanent injury	Second-degree and third-degree burns	Severely toxic	Toxic chemicals, LL_{50} 50 mg/kg	TLm below 1 ppm	Heavy oils, colored or malodorous	React with each other and all other grades	Vigorous reaction, likely to be hazardous	Self-oxidizing chemical, capable of explosion or detonation

*"Evaluation of the Hazard of Bulk Water Transportation of Industrial Chemicals (A Tentative Guide)", National Academy of Sciences, July 1973, Work Performed for U.S. Coast Guard Under Contract [illegible] 771-A, DOT-CG-00035, Task Order 13.

TABLE A-9. HAZARD RATING FOR SELECTED INDIVIDUAL CHEMICALS IDENTIFIED IN UCC WASTES* †

Chemicals	Fire	Health			Water Pollution			Reactivity		
	I	Vapor Irritant II	Liquid Solid Irritant III	Poisons IV	Human Toxicity V	Aquatic Toxicity VI	Aesthetic Effect VII	Other Chemicals VIII	Water IX	Self Reaction X
Acetone	3	1	0	0	1	1	1	2	0	1
Acrylonitrile	3	3	1	3	4	3	2	3	0	3
Butanol (n-)	3	1	1	2	2	2	2	2	0	0
Dichlorobenzene (ortho isomer)	1	2	1	1	1	3	2	1	0	0
Epichlorohydrin	3	3	3	4	3	3	2	3	1	2
Ethanol	3	1	0	1	1	1	1	2	0	0
Isopropanol	3	1	0	2	2	2	1	2	0	0
Monochlorobenzene	3	0	1	2	1	3	2	1	0	0
Methanol	3	1	1	2	1	1	1	2	0	0
Methyl Ethyl Ketone	3	1	1	2	2	1	1	2	0	0
Methyl Isobutyl Ketone	3	1	1	1	2	1	2	2	0	0
Styrene (monomer)	3	2	2	2	1	3	2	2	0	3
Toluene	3	1	1	2	1	3	2	1	0	0
Trichloroethylene	1	1	1	2	1	2	2	1	0	1
Xylene	3	1	1	2	1	3	2	1	0	0

*Based on rating of chemicals presented in the following reference: "Evaluation of the Hazard of Bulk Water Transportation of Industrial Chemicals (A Tentative Guide)", National Academy of Sciences, July 1973; Work Performed for U.S. Coast Guard under Contract GC-11, 775-A, DOT-OS-00035, Task Order 13.

† See Table A-8 for description of numerical hazard ratings.

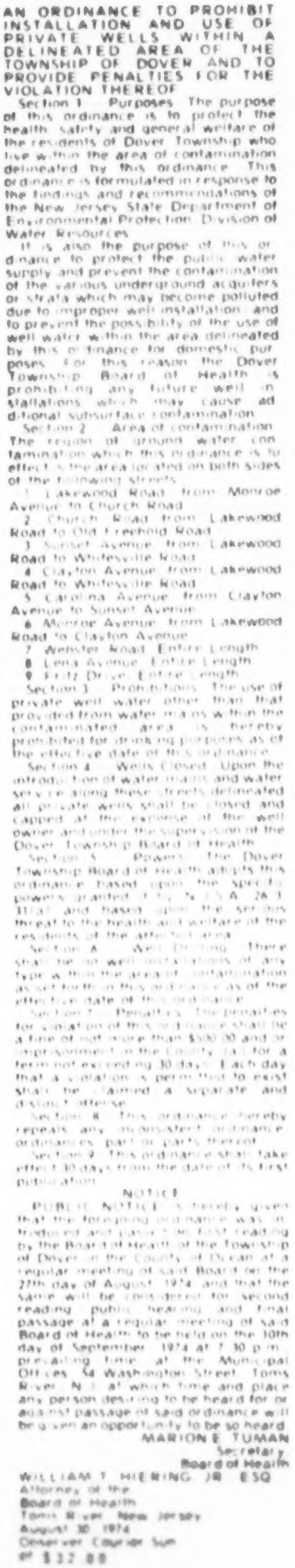
APPENDIX B

DOCUMENTS PERTAINING TO CONDEMNATION OF WELLS, DELINEATION OF THE AFFECTED AREA, AND RECOMMENDED PROCEDURES FOR INSTALLATION OF WELLS IN DOVER TOWNSHIP

- An ordinance to prohibit the installation and use of private wells within a delineated area of the Township of Dover and to provide penalties for the violation thereof (Exhibit B-1).

- Procedures recommended by State for well installation in Dover Township (Exhibit B-2).

EXHIBIT B-1



AN ORDINANCE TO PROHIBIT INSTALLATION AND USE OF PRIVATE WELLS WITHIN A DELINEATED AREA OF THE TOWNSHIP OF DOVER AND TO PROVIDE PENALTIES FOR THE VIOLATION THEREOF

Section 1 Purposes. The purpose of this ordinance is to protect the health, safety and general welfare of the residents of Dover Township who live within the area of contamination delineated by this ordinance. This ordinance is formulated in response to the findings and recommendations of the New Jersey State Department of Environmental Protection, Division of Water Resources.

It is also the purpose of this ordinance to protect the public water supply and prevent the contamination of the various underground acquifers or strata which may become polluted due to improper well installation, and to prevent the possibility of the use of well water within the area delineated by this ordinance for domestic purposes. For this reason the Dover Township Board of Health is prohibiting any future well installations which may cause additional subsurface contamination.

Section 2 Area of contamination. The region of ground water contamination which this ordinance is to effect is the area located on both sides of the following streets:

1. Lakewood Road from Monroe Avenue to Church Road
2. Church Road from Lakewood Road to Old Freehold Road
3. Sunset Avenue from Lakewood Road to Whitesville Road
4. Clayton Avenue from Lakewood Road to Whitesville Road
5. Carolina Avenue from Clayton Avenue to Sunset Avenue
6. Monroe Avenue from Lakewood Road to Clayton Avenue
7. Webster Road, Entire Length
8. Lena Avenue, Entire Length
9. Fritz Drive, Entire Length

Section 3 Prohibitions. The use of private well water other than that provided from water mains within the contaminated area is hereby prohibited for drinking purposes as of the effective date of this ordinance.

Section 4 Wells Closed. Upon the introduction of water mains and water service along these streets delineated, all private wells shall be closed and capped at the expense of the well owner and under the supervision of the Dover Township Board of Health.

Section 5 Powers. The Dover Township Board of Health adopts this ordinance based upon the specific powers granted it by N.J.S.A. 26:3-31(a) and based upon the serious threat to the health and welfare of the residents of the affected area.

Section 6 Well Drilling. There shall be no well installations of any type within the area of contamination as set forth in this ordinance as of the effective date of this ordinance.

Section 7 Penalties. The penalties for violation of this ordinance shall be a fine of not more than $500.00 and/or imprisonment in the County Jail for a term not exceeding 30 days. Each day that a violation is permitted to exist shall be claimed a separate and distinct offense.

Section 8. This ordinance hereby repeals any inconsistent ordinance, ordinances, part or parts thereof.

Section 9. This ordinance shall take effect 30 days from the date of its first publication.

NOTICE

PUBLIC NOTICE is hereby given that the foregoing ordinance was introduced and passed on first reading by the Board of Health of the Township of Dover in the County of Ocean at a regular meeting of said Board on the 27th day of August, 1974 and that the same will be considered for second reading, public hearing and final passage at a regular meeting of said Board of Health to be held on the 10th day of September, 1974 at 7:30 p.m. prevailing time, at the Municipal Offices, 54 Washington Street, Toms River, N.J., at which time and place any person desiring to be heard for or against passage of said ordinance will be given an opportunity to be so heard.

MARION E. TUMAN
Secretary
Board of Health

WILLIAM T. HIERING, JR. ESQ.
Attorney of the
Board of Health
Toms River, New Jersey
August 30, 1974
Observer Courier Sun
pf $12.88

8 - 74

RESOLUTION

WHEREAS, the Dover Township Board of Health has recevied additional information concerning the Department of Environmental Protection's position in regard to the uses of well water within the Pleasant Plains Section of Dover Township; and

WHEREAS, said Department's research has concluded that all wells within the above area should be closed and sealed.

NOW, THEREFORE, BE IT RESOLVED by the BOARD OF HEALTH of the TOWNSHIP OF DOVER, COUNTY OF OCEAN and STATE OF NEW JERSEY, as follows:

1. That the following portion of Section 1 of Ordinance entitled "AN ORDINANCE TO PROHIBIT INSTALLATION AND USE OF PRIVATE WELLS WITHIN A DELINEATED AREA OF THE TOWNSHIP OF DOVER AND TO PROVIDE PENALTIES FOR THE VIOLATION THEREOF." shall be deleted:

"for domestic purposes"

and in its place and stead the following shall be inserted:

"for any purpose"

2. That the following portion of Section 4 of the aforementioned Ordinance shall be deleted:

"capped"

and in its place and stead the following shall be inserted:

"sealed"

3. That a copy of this resolution be forwarded to L. Manuel Hirshblond, Clerk-Administrator of the Township of Dover.

CERTIFICATION

I, MARIAN TUMAN, Secretary of the Dover Township Board of Health, of the County of Ocean, State of New Jersey, do hereby certify that the foregoing is a true copy of a Resolution adopted by the Dover Township Board of Health at its meeting duly held on the 16th day of September, 1974. Said meeting was the continuation meeting for it's Tuesday, September 10, 1974 regular meeting which was recessed.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the seal of the Dover Township Board of Health.

Marian Tuman
MARIAN TUMAN
Secretary, Dover Township Board of Health

Reproduced from best available copy.

EXHIBIT B-2

PROCEDURES FOR WELL INSTALLATIONS IN DOVER TOWNSHIP

The following procedures are to be followed for all individual well installations that will be installed in the territorial boundaries of Dover Township.

These procedures will fall into two categories -- the first category concerns the area in close proximity to Pleasant Plains. The area is outlined on the attached map.

In Zone 1 of this map there are to be no wells installed.

In Zone 2 the following procedures are to be followed:

1. A registered and licensed well driller must be utilized.
2. A State Permit must be secured and approved by the State Geologist to insure the proper depth so that the wells are installed in the Kirkwood formation.
3. Upon receipt of the State Permit, a Township Permit may be issued. The well driller must be informed that the drilling method must be of the type that will not permit any vertical leakage from the overlying Cohansey formation to the Kirkwood.
4. Samples or well cuttings are to be taken every ten feet or change of formation. The State Geologist Office is to be informed when drilling starts at a given location so it can monitor, if necessary, the operation and check the well cuttings, thereby assisting the driller(s) until they can carry on themselves.
5. (a.) Prior to installing drop lines and seal, the Board of Health must be contacted so that the well depth can be determined.

   (b.) After installation of all equipment the Board of Health must be contacted so that an inspection can be made to insure proper seal and location.
6. A letter must be received from the State Geologist indicating that the depth of the well is acceptable by the State Department of Environmental Protection.
7. Water analyses must be conducted for bacterial, chemical and volatile organics. A copy of the water analyses and well record is to be submitted to the Board of Health. Upon approval of the above, a Certificate of Occupancy will be issued.

Wells outside of Zone 2:

1. A registered and licensed well driller must be utilized.
2. A State Permit must be secured. Upon receipt of State Well Drilling Permit, a local Permit can be issued.
3. Prior to installation of drop lines and seal, the Board of Health must be contacted.

APPENDIX C

DOCUMENTS AND NEWSPAPER ACCOUNTS PERTAINING TO ACTUAL OR SUSPECTED LOCATIONS WHERE DUMPING OF CHEMICAL WASTES HAVE TAKEN PLACE.

- Selected affidavits from the court records pertaining to the case "Township of Dover and Board of Health of the Township of Dover, vs. Union Carbide and Nicholas Fernicola". (Exhibits C-1 through C-4)

- Civil Action Complaint filed by the State of New Jersey Department of Environmental Protection against Union Carbide Corporation and Nicholas Fernicola (Exhibit C-5)

- Letter from Charles Kauffman, Ocean County Public Health Coordinator, to David J. Bardin, Department of Environmental Protection, State of New Jersey. (Exhibit C-6)

- "Explosive Chemical Buried for 5 Years", Asbury Park Press, August 23, 1974. (Exhibit C-7)

- "Berkeley Water Given State OK", Asbury Park Press, September 5, 1974. (Exhibit C-8)

- "Union Carbide to Remove Two Drum Laden Trucks", Ocean County Daily Times, July 12, 1974. (Exhibit C-9)

- "Trucker Defends Storage of Wastes in Dover", Asbury Park Press, August 4, 1974. (Exhibit C-10)

EXHIBIT C-1

STATE OF NEW JERSEY)
) s.s.
COUNTY OF OCEAN)

ROBERT BRUNE, of full age, certifies and says:

1. I am the Mayor of the Township of Dover and, with the other members of the Township Committee, am entrusted with responsibility generally for the safety and welfare of the inhabitants of the Township of Dover.

2. On January 28, 1972, I inspected the premises at 1579 Lakewood Road, Toms River and saw about 3,000 fifty-five gallon drums all over the property, which drums were labelled to indicate that they contained chemicals of a flammable nature.

3. Based on information I received from a number of sources, I learned that the drums were placed on the property by Nicholas Fernicola, 17 West Ridge Drive, Toms River, in an area rented from Mr. and Mrs. Samuel Reich. I also learned that the drums came from Union Carbide, River Road, Bound Brook, New Jersey.

4. I spoke to Edward Moherek of Union Carbide who told me that Union Carbide had contracted with the said

EXHIBIT C-1
(CONTINUED)

Nicholas Fernicola to dispose of their drums of waste chemicals, including flammable liquids. I asked Moherek to have Union Carbide arrange to have the drums removed from the premises and disposed of elsewhere, but he refused to cooperate and acknowledged no responsibility for the disposal of the chemicals.

5. I was particularly concerned because we had a fire in our own Township dump recently, which I have been informed was caused by the dumping of similar drums of chemicals transported there by said Nicholas Fernicola.

6. I have been informed that the potential fire hazard resulting from the storage of said drums poses a serious threat to the safety and welfare of the residents of the area and other parts of the Township of Dover, a threat to life and property including homes, commercial structures and forests. I have directed the Township Attorney to seek the injunctive relief for which this Affidavit is made.

I certify that the foregoing statements made by me are true. I am aware that if any of the foregoing statements made by me are wilfully false, I am subject to punishment.

ROBERT BRUNE

DATED: January 29, 1972.

EXHIBIT C-2

STATE OF NEW JERSEY)
) s.s.
COUNTY OF OCEAN)

RICHARD WINTON, of full age, certifies and says:

1. I live at 921 Briar Avenue, Toms River, New Jersey, and was formerly employed during the summer of 1971 by Nicholas Fernicola.

2. My job with said Nicholas Fernicola was to drive a truck to Union Carbide in Bound Brook, pick up loads of steel drums containing chemicals and return same to premises at 1579 Lakewood Road, Toms River.

3. Occasionly, I would be required to dump chemical wastes at the Dover Township municipal landfill.

4. On occasions prior to December of 1971 Frank Fernicola, the brother of said Nicholas Fernicola, who was in the same type of business, ie. disposal of waste chemicals, would often exchange favors with said Nicholas Fernicola. An example of this was the use by Frank Fernicola of a truck owned by said Nicholas Fernicola about one year ago.

5. Both Frank Fernicola and Nicholas Fernicola have at times dumped chemical waste and drums containing

EXHIBIT C-2
(CONTINUED)

chemical waste in the Dover Township landfill.

6. A representative of Union Carbide came down to Toms River and saw the drums on the Lakewood Road property but I cannot remember the exact date or what was said by the representative to Nicholas Fernicola.

7. At the premises on Lakewood Road a number of trenches have been dug into which the contents of many of the drums have been poured.

8. Approximately 4,500 drums are still on the propertyof which about 90% are filled with chemical waste.

9. I make this certification in lieu of affidavit in connection with an application for injunctive relief by the Township of Dover to which this certification is attached and made a part hereof.

I certify that the foregoing statements made by me are true. I am aware that if any of the foregoing statements made by me are wilfully false, I am subject to punishment.

Richard Winton
RICHARD WINTON

DATED: January 30, 1972.

EXHIBIT C-3

STATE OF NEW JERSEY)
) s.s.
COUNTY OF OCEAN)

BRUCE EGELAND, of full age, certifies and says:

1. I am a Detective-Lieutenant with the Manchester Township Police Force.

2. In November of 1971, a bulldozer-operator at the municipal township landfill struck a buried drum of chemical waste with the edge of his blade which set off an explosion, resulting in burns to the operator. Other drums were discovered in the dump, some of which had leakeage.

3. I conducted an investigation and ascertained that the drums were buried by Nicholas Fernicola, 17 West Ridge Drive, Toms River. Said Nicholas Fernicola admitted to me that he dumped 92 of the drums of chemical waste, which was highly flammable, in the Manchester Township landfill. During the investigation, Fernicola was picked up attempting to dump 15 more drums in the Whiting landfill.

4. In addition, Fernicola admitted to me that he was responsible for the recent explosion and fire in the Dover Township landfill, as well as the aforesaid explosion

EXHIBIT C-3
(CONTINUED)

in the Manchester landfill, stating that he had placed the drums in both dumps.

5. Fernicola told me that he would dispose of chemical waste from a number of companies including Union Carbide. A State Police analysis from some drums of Essex Chemical Company indicated the fluid contained therein had the consistency of lighter fluid and gasoline.

6. Fernicola told me that he had a great number of these drums in Dover Township, stating that to make money he had to take the full drums as well as the empty ones. He added that he hauled a great number out of Union Carbide.

7. At the time we were conducting the investigation of the fire at our municipal landfill I called Union Carbide in Bound Brook and spoke to a man in the disposal unit, telling him that we were having a problem with material being dumped and we suspected that some of it came from Union Carbide. We never received confirmation from Union Carbide as to whether this was true.

I certify that the foregoing statements made by me are true. I am aware that if any of the foregoing statements made by me are wilfully false, I am subject to punishment.

Bruce Egeland

BRUCE EGELAND

DATED: January [illegible], 1972.

EXHIBIT C-4

STATE OF NEW JERSEY)
) s.s.
COUNTY OF OCEAN   )

DAVID ASCIONE, of full age, certifies and says:

1. I am the Fire Chief of Pleasant Plains Fire Company, in the Township of Dover.

2. On January 29, 1972 I made an inspection of the premises at 1579 Lakewood Road, Toms River, New Jersey and found a great number of steel drums labelled or marked as containing chemical waste, waste oil, toluene, styrene and other flammable products. I estimated more than 1,000 steel drums to be on the premises either on the ground or in trucks.

3. I moved about 4 of the drums and found that 2 were filled.

4. The ground was covered with the material from the drums in several places, and the odor emanating from it was very strong.

5. If the contents were as the labels or markings indicated, the fire and explosion hazard presented would be extraordinarily severe, and the problems involved in fighting

EXHIBIT C-4
(CONTINUED)

a fire resulting from the combustion of these materials would be enormous and, perhaps, impossible.

I certify that the foregoing statements made by me are true. I am awre that if any of the foregoing statements made by me are wilfully false, I am subject to punishment.

DAVID ASCIONE

DATED: January ,, 1972.

EXHIBIT C-5

WILLIAM F. HYLAND
ATTORNEY GENERAL OF NEW JERSEY
Attorney for Plaintiff
36 West State Street
Trenton, New Jersey 08625
By: LAWRENCE E. STANLEY
Deputy Attorney General
(609) 292-1566

SUPERIOR COURT OF NEW JERSEY
CHANCERY DIVISION, OCEAN COUNTY
DOCKET NO.

STATE OF NEW JERSEY, DEPARTMENT)
OF ENVIRONMENTAL PROTECTION,
) Civil Action
Plaintiff,
v.) COMPLAINT

UNION CARBIDE CORPORATION, a)
corporation of the State of
New York, and NICHOLAS FERNICOLA,)

Defendants.)

The plaintiff, State of New Jersey, Department of Environmental Protection (hereinafter "Department"), with offices located at John Fitch Plaza, City of Trenton, County of Mercer, State of New Jersey, by way of complaint says:

EXHIBIT C-5
(CONTINUED)

COUNT I

1. The Department is one of the principal departments of the government of the State of New Jersey and is empowered to exercise the responsibility of the State for protecting the public interest in the environment and in the natural resources of the State.

2. The State of New Jersey is the holder in trust for all of its inhabitants of the natural resources of the State and, particularly, is the holder of a property interest in all of the groundwater contained in and moving through the natural underground reservoirs and aquifers within the State in trust for all of its inhabitants.

3. The defendant, Union Carbide Corporation (hereinafter "Union Carbide"), a corporation of the State of New York, maintains a place of business on River Road, Borough of Bound Brook, New Jersey, at which site it is engaged in the manufacture and processing of chemicals and plastics, and at which site it was so engaged at all times referred to in this complaint. As by-products of its business activities conducted at its Bound Brook plant, Union Carbide generates and accumulates liquid chemical waste.

4. On April 5, 1971, Union Carbide executed a written agreement with defendant, Nicholas Fernicola (hereinafter "Fernicola") providing that Union Carbide would pay Fernicola to remove drummed

EXHIBIT C-5
(CONTINUED)

liquid chemical waste from Union Carbide's Bound Brook plant and to dispose of same in a landfill, at the rate of $3.50 per 55-gallon drum.

5. During the period beginning on or about April 5, 1971, and continuing until May 12, 1971, and again during the period beginning August 3, 1971, and continuing until December 16, 1971, Fernicola regularly removed truckloads of drums containing liquid chemical waste from the Union Carbide plant at Bound Brook pursuant to said agreement of April 5, 1971.

6. Between April 5, 1971 and May 12, 1971, Fernicola transported approximately 2,000 of said drums to the municipal landfill located in and owned and operated by Dover Township, Ocean County, New Jersey, and deposited said drums there, with full knowledge of Union Carbide. The Dover Township landfill was not then nor has it ever been approved by the Department for the disposal of liquid chemical waste.

7. Between August 3, 1971 and December 16, 1971, Fernicola transported approximately 4,500 of said drums to a parcel of land known as 1579 Lakewood Road, Dover Township, Ocean County, New Jersey, owned during said period by Samuel Reich and his wife Bertha Reich (hereinafter the "Reich Property"), and deposited same there. The Reich Property has never been approved by the Department for the disposal of liquid chemical waste.

EXHIBIT C-5
(CONTINUED)

8. All of said liquid chemical waste transported and deposited by Fernicola as aforesaid was of a hazardous and toxic nature and was unfit for human ingestion. Its presence in water in small concentrations would render such water unfit for human consumption.

9. The soil located in and under the Dover Township landfill and the Reich Property is in the geological stratum known as the Cohansey Formation and is highly permeable, permitting the rapid percolation of water and other liquids from the surface of the ground to the groundwater table. The Cohansey Formation is a major groundwater aquifer constituting a valuable reservoir of water which is normally pure and well suited for human consumption. This aquifer is the prime source of water for human consumption in Dover Township and in surrounding areas.

10. In depositing said drums at the Dover Township landfill and at the Reich Property, Fernicola failed to take any reasonable precautions against the possibility of leakage or spillage of said liquid chemical waste into the soil and into the Cohansey aquifer.

11. In particular, Fernicola deposited said drums at the Reich Property as aforesaid, in a manner which caused many of said drums to spill or leak liquid chemical waste onto the ground and into several deep trenches on said property; and emptied the liquid

EXHIBIT C-5
(CONTINUED)

chemical waste contained in many of said drums onto the ground and into said trenches.

12. As a result of the aforesaid actions of Fernicola, substantial amounts of the liquid chemical waste deposited by Fernicola at the Dover Township landfill and at the Reich Property have permeated and percolated through the soil, and have seeped into and permeated the groundwater of the Cohansey aquifer in the vicinity of said properties.

13. Said liquid chemical waste which has permeated the groundwater in the vicinity of the Reich Property has since moved with and through the groundwater, permeating the Cohansey aquifer throughout a section of Dover Township being approximately one square mile in area and being known as the Pleasant Plains section.

14. As a result of the aforesaid permeation by said liquid chemical waste, the groundwater in the affected portion of the aquifer underlying the said Pleasant Plains section has been severely damaged and diminished in value. In particular, said groundwater has been contaminated and rendered impure and unfit for human consumption as a result of which approximately 140 wells in said section have been condemned by the Department.

15. As a result of the aforesaid permeation by said liquid chemical waste, the groundwater in the portion of the Cohansey aquifer underlying those areas of Dover Township surrounding the

EXHIBIT C-5
(CONTINUED)

Pleasant Plains section and the Dover Township landfill has been severely damaged and diminished in value because of the present substantial danger that the permeation by said liquid chemical waste will spread into said groundwater.

16. The aforesaid permeation of liquid chemical waste into the Cohansey aquifer constitutes a public nuisance in that it creates a danger that inhabitants of and visitors to the Dover Township area may ingest water unfit for human consumption or may be required to take extensive and costly precautions or may be required to seek costly alternative sources of water supply.

WHEREFORE, the Department demands judgment ordering Union Carbide to take all steps necessary to abate said danger.

COUNT II

1. The Department repeats all of the allegations made in Count I of this complaint and incorporates them herein as if more fully set forth.

2. As a result of the aforesaid permeation the Department has been required to exert great efforts to determine the extent and location of the aforesaid damage to the public water supply in the Cohansey aquifer and the best means of curing or mitigating said damage; and further, the Department has been required to continue said efforts and to monitor the extent and

location of said damage and will continue to be required to exert all of said efforts for an extended period of time hereafter; all at considerable cost and expense to the State of New Jersey.

3. Disposal in landfills of liquid chemical waste of the type delivered by Union Carbide to Fernicola for disposal creates a very high risk of harm to the groundwater resources of the State, which risk is inherent in said activity.

4. Union Carbide had a non-delegable duty to the public to exercise reasonable care to prevent contamination of the public water supply resulting from the disposal in landfills of its liquid chemical waste which it failed to exercise, as a result of which the aforesaid damage occurred and as a result of which the State of New Jersey has been and will be required to exert the aforesaid efforts and incur the aforesaid expenditures.

5. In its acts and omissions as set forth above, Union Carbide acted with knowledge of and with wanton and reckless indifference to the high risk of damage to the public water supply.

WHEREFORE, the Department demands judgment against Union Carbide:

(a) Ordering Union Carbide to take all steps necessary to abate the aforesaid danger; and

(b) For compensatory and punitive damages.

EXHIBIT C-5
(CONTINUED)

COUNT III

1. The Department repeats all of the allegations made in Counts I and II of this complaint and incorporates them herein as if more fully set forth.

2. On April 5, 1971, Fernicola was not licensed or registered as a hauler or collector of waste by either the State Board of Public Utility Commissioners or the Department, nor has he ever been so licensed or registered.

3. At such time and at all times mentioned in this complaint, Fernicola was unable to respond financially to any substantial claim for damages which might have arisen from any injuries resulting from disposal by him of liquid chemical waste.

4. Prior to the agreement of April 5, 1971 with Union Carbide, Fernicola was not regularly in the business of hauling or collecting waste for disposal.

5. At the time of the agreement of April 5, 1971, Fernicola did not have the necessary skill, experience, competence or responsibility to dispose of liquid chemical waste in a landfill without creating a very high risk of damage to the public water supply.

6. All of the facts alleged in paragraphs two through five of this Count, inclusive, were known to Union Carbide at the time of the execution of the aforesaid agreement of April 5, 1971.

EXHIBIT C-5
(CONTINUED)

7. Union Carbide failed to exercise reasonable care in selecting Fernicola as a contractor for the purpose of disposing of liquid chemical waste in landfills as a result of which all of the aforesaid damage to the public water supply occurred and the aforesaid danger exists, and as a result of which the State of New Jersey has been and will continue to be required to make the aforesaid efforts and expenditures.

8. In entrusting liquid chemical waste to Fernicola for disposal in landfills Union Carbide acted with knowledge of and with wanton and reckless indifference to the high risk of harm to the public water supply.

WHEREFORE, the Department demands judgment against Union Carbide:

(a) Ordering Union Carbide to take all steps necessary to abate the aforesaid danger; and

(b) For compensatory and punitive damages.

COUNT IV

1. The Department repeats all of the allegations made in Counts I, II and III of this complaint and incorporates them herein as if more fully set forth.

2. As a result of lawsuits commenced against it by Samuel and Bertha Reich, Dover Township and Dover Township Board

of Health in January of 1972 and an order of the Superior Court Chancery Division, entered therein, Union Carbide undertook during the months of January and February of 1972 to remove from the aforesaid Reich Property all of the drums deposited thereon by Fernicola and all the soil contaminated by liquid chemical waste.

3. In or about March of 1972 Union Carbide announced and gave the public reason to believe that it had removed all of said drums and said soil contaminated by liquid chemical waste from the Reich Property.

4. Union Carbide failed to remove all of said drums and all of said soil contaminated by liquid chemical waste as of March of 1972, but allowed many of said drums and much of said soil to remain beneath the surface of the Reich Property until July 11, 1974 at which time Union Carbide excavated and removed the remainder of said drums.

5. Union Carbide failed to exercise such reasonable care as would have resulted in the removal during January and February of 1972 of all of said drums and all of said soil contaminated by liquid chemical waste, as a result of which said drums and said liquid chemical waste were allowed to remain in the soil and to continue to percolate into the Cohansey aquifer from approximately December of 1971 until at least July 11, 1974, resulting in all of the aforesaid damage, danger, efforts and expenditures.

EXHIBIT C-5
(CONTINUED)

6. In failing to remove said drums and said liquid chemical waste, Union Carbide acted with knowledge of and with wanton and reckless indifference to the high risk of damage to the public water supply.

WHEREFORE, the Department demands judgment against Union Carbide:

(a) Ordering Union Carbide to take all steps necessary to abate the aforesaid danger; and

(b) For compensatory and punitive damages.

COUNT V

1. The Department repeats all of the allegations made in Counts I, II, III and IV of this complaint and incorporates them herein as if more fully set forth.

2. Dover Township, a municipal corporation of the State of New Jersey, obtains water for domestic use for most of its inhabitants from several wells owned and operated by the Toms River Water Company which draw from the groundwater reservoir of the Cohansey Formation. In relation to the general movement of groundwater in the Cohansey aquifer, said wells are located downstream from the Reich Property.

3. Union Carbide permitted liquid chemical waste to remain in the permeable soil of the Reich Property immediately above the water table of the Cohansey aquifer, and in the refuse

of the Dover Township landfill immediately above the permeable soil separating the landfill from the Cohansey aquifer; and allowed said wastes to continually seep into said aquifer at both locations, on each day between December 31, 1971 and July 11, 1974 at the Reich Property; and on each day between December 31, 1971 and at least December 12, 1975 at the Dover Township landfill; in violation of N.J.S.A. 58:10-1.

WHEREFORE, the Department demands judgment against Union Carbide:

(a) Ordering Union Carbide to cease further violations of N.J.S.A. 58:10-1; and

(b) Imposing upon Union Carbide the maximum penalty permitted by N.J.S.A. 58:10-1 for each of the above violations.

COUNT VI

1. The Department repeats all of the allegations made in Counts I, II, III, IV and V of this complaint and incorporates them herein as if more fully set forth.

2. The acts and omissions of Union Carbide set forth in Count V, paragraph 3, of this complaint constitute separate violations of N.J.S.A. 23:5-28 on each of the aforesaid days during which the conditions referred to in Count V continued and do continue.

EXHIBIT C-5
(CONTINUED)

WHEREFORE, the Department demands judgment against Union Carbide:

(a) Ordering Union Carbide to cease further violations of N.J.S.A. 23:5-28; and

(b) Imposing upon Union Carbide the maximum penalty permitted by N.J.S.A. 23:5-28 for each of the above violations.

COUNT VII

1. The Department repeats all of the allegations made in Counts I, II, III, IV and V of this complaint and incorporates them herein as if more fully set forth.

2. By his acts and omissions as more fully set forth above, and by his failure to remove any of said liquid chemical waste from the Dover Township landfill or from the Reich Property, the defendant, Fernicola, has violated N.J.S.A. 58:10-1 and N.J.S.A. 23:5-28 on each day from April 5, 1971 to December 12, 1975.

WHEREFORE, the Department demands judgment against Nicholas Fernicola imposing penalties pursuant to N.J.S.A. 58:10-1 and N.J.S.A. 23:5-28 for each of the above violations.

WILLIAM F. HYLAND
ATTORNEY GENERAL OF NEW JERSEY
Attorney for Plaintiff

By Lawrence E. Stanley
Lawrence E. Stanley
Deputy Attorney General

EXHIBIT C-6

CHARLES KAUFFMAN
Public Health Coordinator

OCEAN COUNTY HEALTH DEPARTMENT
Toms River, N. J. 08753
201-244-2121

August 15, 1974

Hon. David J. Bardin, Commissioner
Department of Environmental Protection
P. O. Box 1540
Trenton, N. J. 08652

Dear Commissioner Bardin:

As requested during the meeting held this date at the Battleground Country Club I am forwarding to you specific locations in which the dumping of chemical wastes have taken place. The extent and damage done by such dumping is as yet undetermined. Further investigation by your forces may find the accountable parties and discover material that may pollute the ground water.

The following locations were given to me by the Chief of Police of South Toms River, Edward G. Hughes:

> Buildings occupied by Fernicola Co. and used for reclaiming drums located on South Main Street, So. Toms River
>
> South Toms River landfill
>
> A dumping area in Berkeley Township located behind Johnson's Asphalt Plant. Lt. Britton of the Berkeley Twp. Police Dept. can supply additional information.

Locations south of Toms River that are suspect and which information has been relayed to me by various concerned individuals:

> Gravel pits in the Pinewald section of Berkeley Township
>
> Landfill located in nearby Ocean Township

EXHIBIT C-6
(CONTINUED)

Hon. David J. Bardin, Commissioner
Dept. of Environmental Protection -2- August 15, 1974

In the central and northern areas of Ocean County there have been confirmed reports of illegal dumping on the Reich Farm, Lakewood Road, Dover Township, Dover Township landfill, the old Manchester Township landfill and the Lakewood Township landfill.

A cache of drums from Printers Service, 26 Blanchard Street and 225 South Street, New York City, telephone numbers 201-589-7500 and 212-WO 2-6565 have been found on 9th Street off of Eltone Road, Jackson and one thousand feet off Fister Road on an old chicken farm in Freehold Township. These caches were discovered by Frank Nemeth, Sanitary Inspector, Jackson Township.

To the best of my knowledge all locations and material found is associated with either Frank or Nick Fernicola who are in the disposal business of carting chemical wastes from Union Carbide and other manufacturers throughout the State.

I hope that you will consider this important enough to assign personnel from your department with the expertise to develop the information caused by the illegal dumping and the resources to properly dispose of any material found during the investigation so as not to cause a hazard either to the environment or the health of the residents of the communities involved.

Sincerely yours

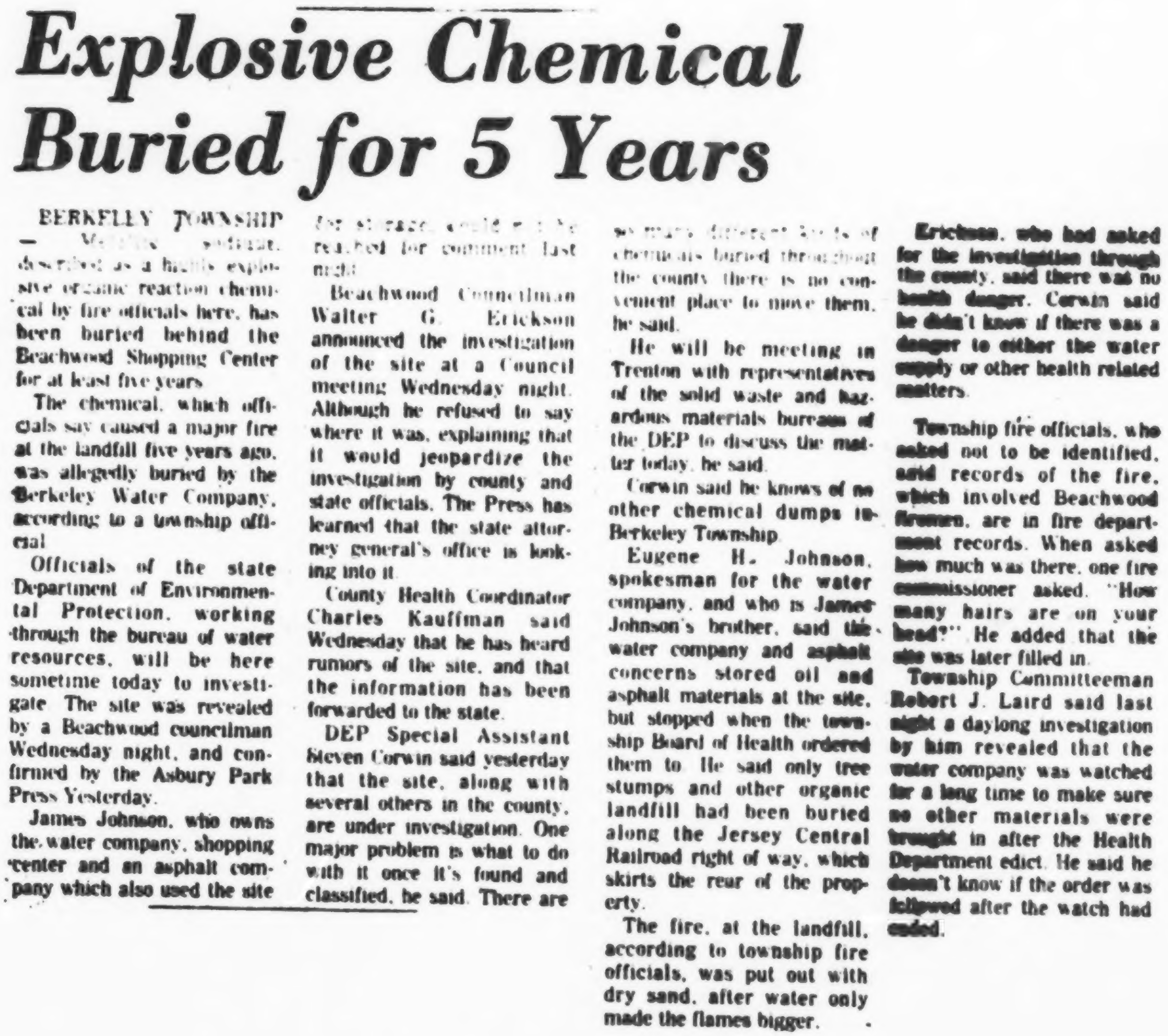
Charles [illegible]
Public Health Coordinator

ck/ss

C/M #432785

cc: Hon. John F. Russo
Hon. Ethel [illegible]
Mr. Charles Pike
Mr. Steven Corwin

EXHIBIT C-7



Explosive Chemical Buried for 5 Years

BERKELEY TOWNSHIP — Metallic sodium, described as a highly explosive organic reaction chemical by fire officials here, has been buried behind the Beachwood Shopping Center for at least five years.

The chemical, which officials say caused a major fire at the landfill five years ago, was allegedly buried by the Berkeley Water Company, according to a township official.

Officials of the state Department of Environmental Protection, working through the bureau of water resources, will be here sometime today to investigate. The site was revealed by a Beachwood councilman Wednesday night, and confirmed by the Asbury Park Press Yesterday.

James Johnson, who owns the water company, shopping center and an asphalt company which also used the site for storage, could not be reached for comment last night.

Beachwood Councilman Walter G. Erickson announced the investigation of the site at a Council meeting Wednesday night. Although he refused to say where it was, explaining that it would jeopardize the investigation by county and state officials, The Press has learned that the state attorney general's office is looking into it.

County Health Coordinator Charles Kauffman said Wednesday that he has heard rumors of the site, and that the information has been forwarded to the state.

DEP Special Assistant Steven Corwin said yesterday that the site, along with several others in the county, are under investigation. One major problem is what to do with it once it's found and classified, he said. There are so many different kinds of chemicals buried throughout the county there is no convenient place to move them, he said.

He will be meeting in Trenton with representatives of the solid waste and hazardous materials bureaus of the DEP to discuss the matter today, he said.

Corwin said he knows of no other chemical dumps in Berkeley Township.

Eugene H. Johnson, spokesman for the water company, and who is James Johnson's brother, said the water company and asphalt concerns stored oil and asphalt materials at the site, but stopped when the township Board of Health ordered them to. He said only tree stumps and other organic landfill had been buried along the Jersey Central Railroad right of way, which skirts the rear of the property.

The fire, at the landfill, according to township fire officials, was put out with dry sand, after water only made the flames bigger.

Erickson, who had asked for the investigation through the county, said there was no health danger. Corwin said he didn't know if there was a danger to either the water supply or other health related matters.

Township fire officials, who asked not to be identified, said records of the fire, which involved Beachwood firemen, are in fire department records. When asked how much was there, one fire commissioner asked, "How many hairs are on your head?" He added that the site was later filled in.

Township Committeeman Robert J. Laird said last night a daylong investigation by him revealed that the water company was watched for a long time to make sure no other materials were brought in after the Health Department edict. He said he doesn't know if the order was followed after the watch had ended.

EXHIBIT C-8

Berkeley Water Given State OK

BERKELEY TOWNSHIP — Water supplied by the Berkeley Water Co. has been declared clean and safe to drink, but reports that various chemicals are buried behind the Beachwood Shopping Center are keeping the state probe of the area alive.

Steven Corwin, special assistant to the state commissioner of environmental protection, said yesterday that samples taken from a water company well near the alleged burial site showed no contamination. Tests were taken after it was learned that metallic sodium, a highly explosive chemical catalyst, had been buried behind the shopping center years ago.

Now, Corwin said, rumors that other kinds of chemicals, including some from a cosmetic factory, are buried there are causing the state to continue looking over the site. Its owner, James E. Johnson, said the metallic sodium was burned when he realized it exploded on contact with water and he feared it would pollute the water company, which he also owns.

Beachwood Councilman Walter G. Ericksen said county and state health officials were investigating the site several weeks ago. Last night, he said he learned there may be more chemicals there, but refused to give details, saying there is no proof.

Corwin said the tests were for Ph, or acidity, and organic pollution. Two were taken because of slightly different results, but both revealed no contamination.

The Asbury Park Press found the site two weeks ago. Johnson told the Press that there are no other chemicals either stored or buried there because the township ordered him to stop using the tract for a landfill five years ago. The only things there are paving materials and oil for his asphalt company, he said.

EXHIBIT C-9

[illegible]
D. [illegible]

JUL 12 1974

Union Carbide To Remove Two Drum Laden Trucks

TOMS RIVER — Dover Township Mayor Ethel Zaun said Union Carbide Inc., has agreed to remove two trucks containing barrels of waste from the firm's Bound Brook plant from an area off Brookside Drive where they were stored.

Mrs. Zaun said the trucks were discovered on Wednesday by Al Gabriel, the superintendent of buildings here.

Mr. Gabriel said they are the same trucks which he found parked off Route 37 last week. When he returned to them the day after he found them they had been moved, but four barrels of chemicals had been left behind.

Mrs. Zaun said none of the drums stored in the trucks were leaking or dumped off Brookside Drive, and Union Carbide will have them removed today.

She said the trucks belong to Nicholas Fernicola, whom local officials believe is responsible for storing more than 3,300 barrels of chemicals on a Route 9 chicken farm in late 1971 and early 1972.

A court ordered the removal of those drums, but officials this week found more of them buried at the site. Union Carbide is removing those barrels as well.

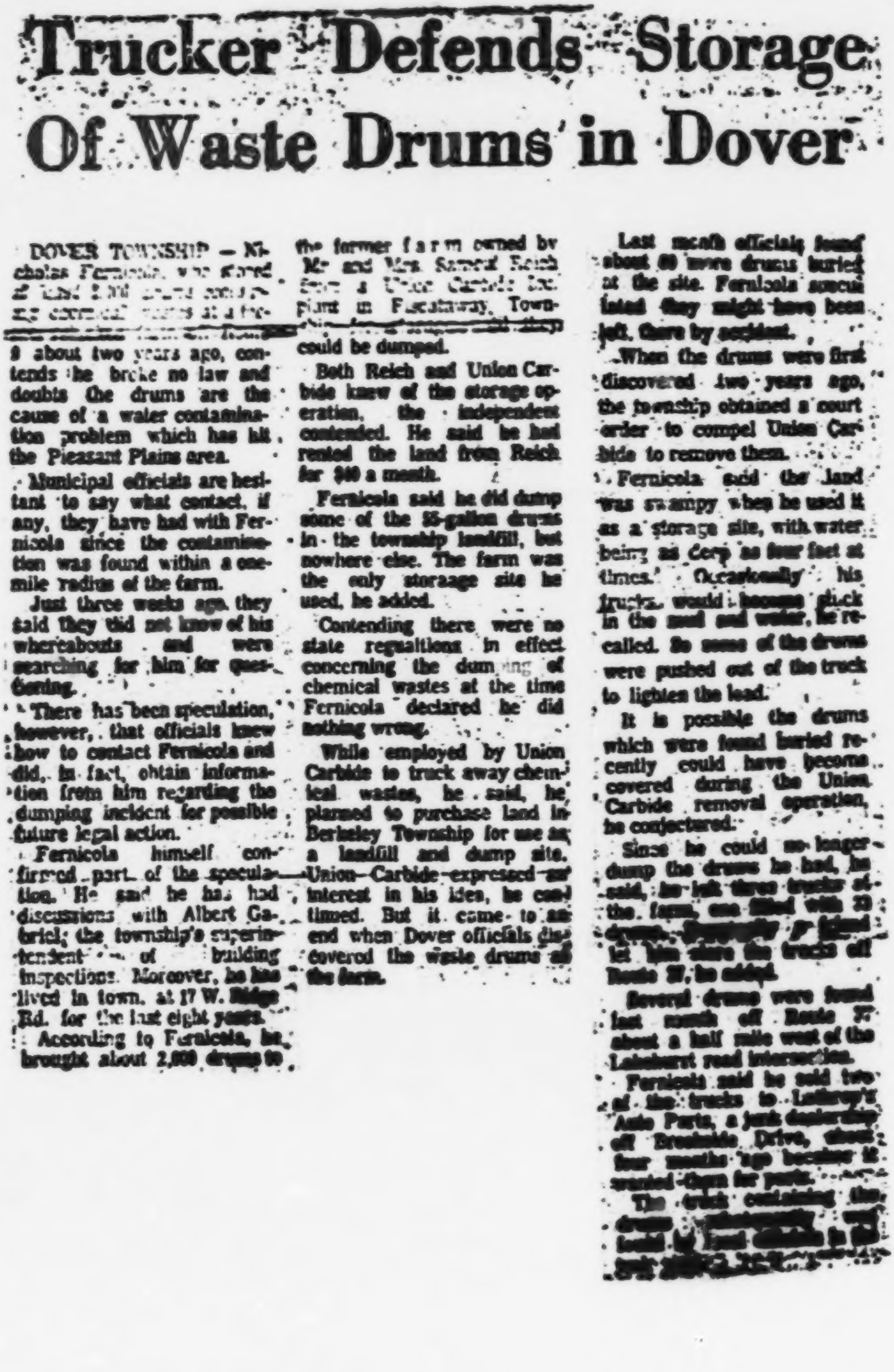
Township officials are eyeing the leaking barrels as the possible source of petro-chemical pollution of private wells in the Pleasant Plains area.

Mrs. Zaun said yesterday that Federal Environmental Protection Agency tests of water samples from several wells of the Toms River Water Company and the Pleasant Plains Fire House showed no signs of serious contamination which would rule out either as a source of drinking water.

Private wells in the area have been found by state chemists to contain petro-chemicals, although they have not defined whether they are harmful or not.

Tuesday night two Republican members of the governing body defeated a plan which would have provided $265,000 to extend city water service to the effected area. They offered no alternative to the measure and the governing body is not trying to work out another plan to bring relief to the area.

EXHIBIT C-10



Trucker Defends Storage Of Waste Drums in Dover

DOVER TOWNSHIP — Nicholas Fernicola, who stored at least 2,000 drums containing chemical wastes at a for- [illegible] 9 about two years ago, contends he broke no law and doubts the drums are the cause of a water contamination problem which has hit the Pleasant Plains area.

Municipal officials are hesitant to say what contact, if any, they have had with Fernicola since the contamination was found within a one-mile radius of the farm.

Just three weeks ago they said they did not know of his whereabouts and were searching for him for questioning.

There has been speculation, however, that officials knew how to contact Fernicola and did, in fact, obtain information from him regarding the dumping incident for possible future legal action.

Fernicola himself confirmed part of the speculation. He said he has had discussions with Albert Gabriel, the township's superintendent of building inspections. Moreover, he has lived in town, at 17 W. Ridge Rd. for the last eight years.

According to Fernicola, he brought about 2,000 drums to the former farm owned by Mr. and Mrs. Samuel Reich from a Union Carbide Inc. plant in Piscataway Township [illegible] they could be dumped.

Both Reich and Union Carbide knew of the storage operation, the independent contended. He said he had rented the land from Reich for $60 a month.

Fernicola said he did dump some of the 55-gallon drums in the township landfill, but nowhere else. The farm was the only storaage site he used, he added.

Contending there were no state regualtions in effect concerning the dumping of chemical wastes at the time Fernicola declared he did nothing wrong.

While employed by Union Carbide to truck away chemical wastes, he said, he planned to purchase land in Berkeley Township for use as a landfill and dump site. Union Carbide expressed an interest in his idea, he continued. But it came to an end when Dover officials discovered the waste drums at the farm.

Last month officials found about 80 more drums buried at the site. Fernicola speculated they might have been left there by accident.

When the drums were first discovered two years ago, the township obtained a court order to compel Union Carbide to remove them.

Fernicola said the land was swampy when he used it as a storage site, with water being as deep as four feet at times. Occasionally his trucks would become stuck in the mud and water, he recalled. So some of the drums were pushed out of the truck to lighten the load.

It is possible the drums which were found buried recently could have become covered during the Union Carbide removal operation, he conjectured.

Since he could no longer dump the drums he had, he said, he left three trucks at the farm, one filled with 23 drums. [illegible] a friend let him store the trucks off Route 37, he added.

Several drums were found last month off Route 37 about a half mile west of the Lakehurst road intersection.

Fernicola said he sold two of the trucks to Lathrop's Auto Parts, a junk dealership off Brookside Drive, about four months ago because it wanted them for parts.

The truck containing the drums [illegible] was found by [illegible] in the [illegible]

APPENDIX D

HAZARDOUS WASTE DISPOSAL DAMAGE REPORT ON THE OPERATION OF THE KIN-BUC LANDFILL, N.J.

EPA/530/SW-151, JUNE 1975

HAZARDOUS WASTE DISPOSAL
DAMAGE REPORT

March 7, 1975

Fatality at a New Jersey Industrial Landfill

1. Personal Damage - Bulldozer operator killed in explosion at landfill

2. Environmental Damage - None which resulted from incident

3. Economic Damage - Bulldozer destroyed; approx. $91,000 damage

4. Cause of Problem - Explosion while burying and compacting drums of unidentified industrial waste chemicals

5. Type and Quantity of Hazardous Waste Involved - From one to five 55-gallon drums of unidentified chemicals

6. Source of Waste - Unknown industrial origin

7. Date of Incident - October 11, 1974

8. Location - EPA Region II, New Jersey, Edison Township, Kin-Buc Landfill

9. Status - Landfill remains active. The case was investigated by the Occupational Safety and Health Administration (OSHA) and New Jersey State authorities.

10. Remedial Action Taken - Management has agreed to make every effort to keep out unknown chemical wastes.

11. Legal Action Taken - The OSHA issued six citations (covering thirty-six items) for violation of the Occupational Safety and Health Act of 1970. A formal settlement of contested items was reached between OSHA and the management on March 4, 1975.

12. Remarks - The Kin-Buc Landfill, located on 30 acres adjacent to the Raritan River, has received both municipal and industrial wastes for about twelve years. It is owned by Kin-Buc, Inc., a subsidiary of Scientific, Inc., of Scotch Plains, N.J.

According to Mr. James Stroin, Vice President of Scientific, the landfill receives approximately 200 truckloads of waste per day, 25% of which is industrial waste. This includes wastes from such industrial categories as organic and inorganic chemicals, pharmaceuticals, paints, plastics, and others.

The wastes are delivered to the site in tank trucks and in containers. Bulk liquids are poured out of the tank trucks on top of the previously deposited waste, while those in containers are buried and then compacted with bulldozers. Mr. Stroin explained that two tests are conducted as a means of identifying the wastes. The first, a test for flammability, is conducted by igniting a sample in a glass beaker. The second is pH testing by indicator paper.

The acceptance of unidentified chemical wastes at landfills has been deemed an unsafe practice by the State of New Jersey and is specifically prohibited in recently promulgated solid waste disposal regulations. However, these regulations had been suspended by court order at the date of the explosion; they have since been reinstated.

According to the OSHA investigation, eleven 55-gallon drums of unknown chemicals had been stored at the site for about six weeks prior to the explosion. On October 11, 1974, one of the managers of the Chemical Waste Division of Scientific, Inc., told an employee to remove these drums for burial. Mr. Donald Amatel, one of the two bulldozer operators working there at the time, had covered five drums of the unidentified industrial waste chemicals and had begun the compacting operation when an explosion occurred. According to the OSHA investigation, a large flame enveloped the bulldozer. Mr. Amatel jumped out of his cab and another explosion followed, which caused burns covering approximately 85% of his body and destroyed the bulldozer beyond recovery. Mr. Amatel died the following day. He had been active in his line of work for about fifteen years.

When interviewed by an EPA official, Mr. Stroin attributed the fatal outcome of the accident to the faulty judgment of the bulldozer operator. He indicated that Mr. Amatel should have stayed in the cab and backed out with the equipment to avoid injury. Witnesses, however, stated that this would not have been possible. In response to questions about possible environmental problems with the landfill, Mr. Stroin conceded that there were occasional problems with contaminants being drained from the landfill after periods of heavy rainfall.

For the first ten months of 1974, six other obviously chemical waste disposal-related occupational injuries were recorded in the Kin-Buc logs, the maintaining of which is required under the Williams-Steiger Occupational Safety and Health Act of 1970 (excluded from this requirement are minor injuries requiring only first aid treatment). The recorded injuries affected two bulldozer operators, a laborer, and two drivers. These injuries, as obtained from the OSHA files, are as follows:

1. Eye irritation sustained while bulldozer operator was pushing drum which split, squirting liquid into eyes.

2. Smoke inhalation which caused respiratory and stomach conditions while operator was fighting a fire on a bulldozer.

3. Conjunctivitis of eyes caused by fumes from waste products. Safety glasses were being worn at the time of injury.

4. Burned foot when driver stepped out of truck into a hole containing 250°F acid waste.

5. Chemical burns to hands and other parts of body as a result of pushing a drum with bulldozer. The drum split open and liquid squirted out.

6. Sustained burn of the cornea when dumping acid from a tank truck.

APPENDIX E

SOME COMMENTS FROM AREA RESIDENTS AND OTHER INDIVIDUALS INTERVIEWED

The field investigation in New Jersey included interviews with a number of residents from the Pleasant Plains section of Dover Township. The following are some comments received directly from the individuals interviewed or attributed by the individuals interviewed to other area residents. The comments may or may not represent the opinion of the majority of the area residents.

1) The property owners of Pleasant Plains are not responsible for the groundwater contamination and strongly feel that the burden of the expense and inconvenience should be placed elsewhere than on property owners.

2) By extending the Toms River Water Company service to the area, the Pleasant Plains residents are not guaranteed a supply of safe and potable water. Some of the company's production wells are located in the same aquifer (Cohansey formation), access to which has been denied to the area residents.

3) The water from the Toms River Water Company (the city water) is inferior to water from private wells. The city water tastes "funny", and forms "rings" around glassware, bathtubs and pots and pans.

4) The decision to condemn wells and to extend the services of Toms River Water Company to the area were based on and represent the economic interest of the Water Company. There are already talks of raising the water bill for the property owners.

5) Because of the high cost of the city water, the residents have to curtail their water consumption, especially during the summer months when a large volume of an inexpensive supply is needed for watering lawns, filling swimming pools, and backyard production of fruits and vegatables.

6) There are inconsistencies in the State's reports on the quality of water from private wells. For example, the well at North Dover Elementary School was originally declared contaminated and was abandoned. Later tests, however, indicated that the well was all right and it is now being used.

7) Delineation of the contaminated area and demarkation of boundaries for Zones I,II and III are somewhat arbitrary and are not based on logical reasoning and engineering data.

8) The people on the Dover Township Board of Health do not have the necessary technical background to make decisions on matters pertaining to water quality, health, etc.

9) Many ailments reported by the area residents in the past few years can probably be attributed to the presence of contaminants in private wells and/or the city water. One area resident made a personal health survey of 51 families and found 21 adults who reported some sort of stomach problem which they had been experiencing for 1-2 years.

10) Use of private wells is a "God-given" right and the property owners should not be denied such a privilege.

11) The Reich Farm and the UCC wastes deposited/stored there should not be singled out as the only source of groundwater contamination. Chemical wastes have been deposited at municipal landfills and at other inappropriate locations. (One resident asserted that there are 1,400 drums of chemicals deposited at the Dover Township landfill.) In addition, a major source of groundwater pollution is the Toms River Chemical Corporation. (One area resident conducted a reconnaissance flight over the Toms River Chemical Corporation facility to obtain photographic evidence documenting the storage/landfilling of waste drums on the premises which were viewed by some residents as major contributing factors to the groundwater pollution.)